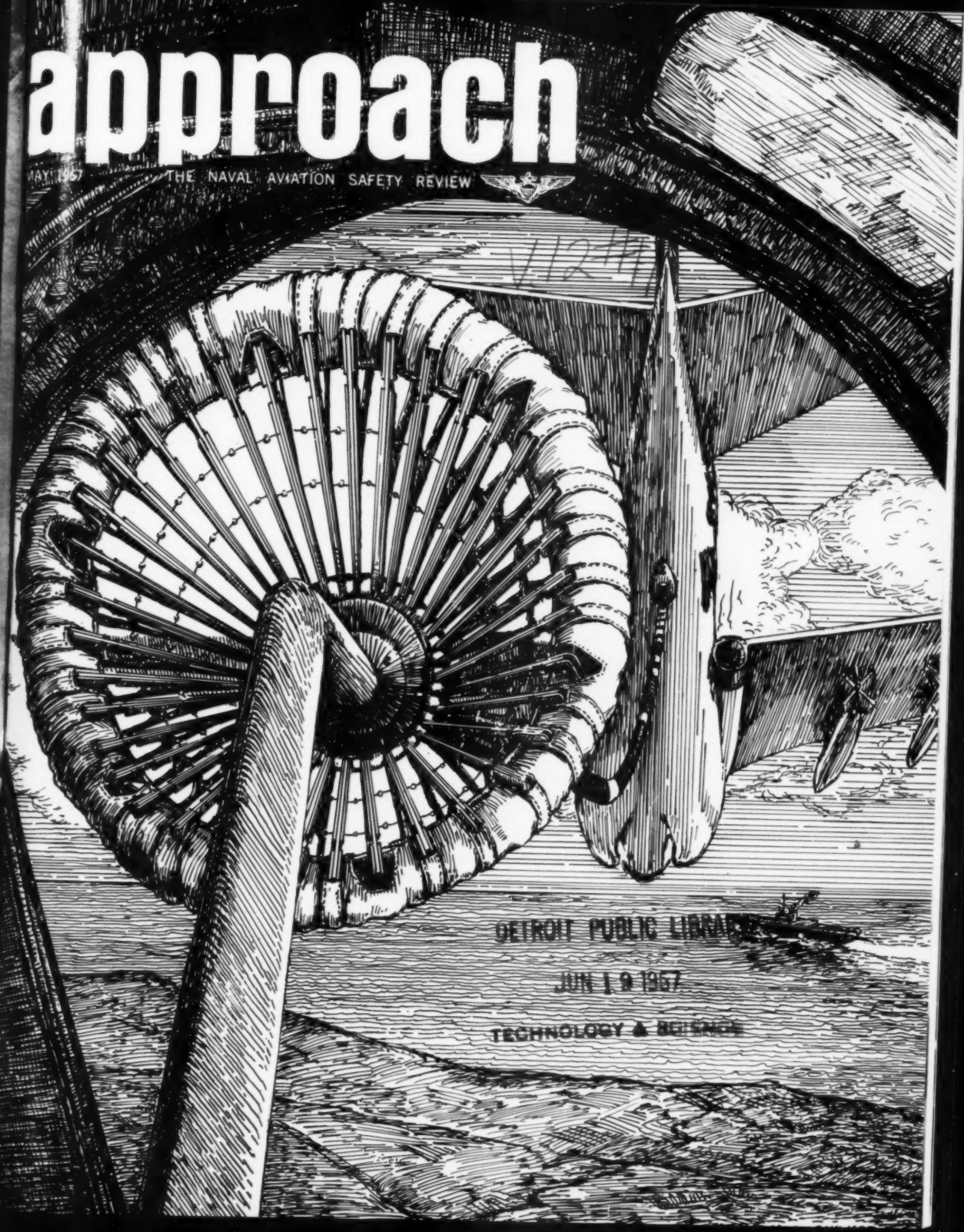
approach

MAY 1957 THE NAVAL AVIATION SAFETY REVIEW



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TECHNOLOGY & SCIENCE

Pilot Technique in Turbulence

Adapted from an article by John B. Clark, American Airlines, Inc.

A wise pilot

...world might through

areas of serious turbulence. Airlines in the United States spend millions of dollars annually in longer routings around turbulence, changes in altitude, delays on the ground, etc., to provide more safety and comfort to their passengers. The fact remains, however, that airliners are sooner or later exposed to flight through turbulent air.

CAT and Thunderstorms Compared—The two principal types of turbulence are clear air turbulence, commonly known as CAT and the disturbed air associated with convective type clouds, the worst of which are called thunderstorms. The two vary in energy source, in predictability, and in their ability to be seen visually or by radar. The cycles, wave lengths and time histories of gusts and drafts vary greatly between CAT and thunderstorms. Finally, the thunderstorm is much more awe-inspiring to be near, or to be in.

As an oversimplification, trouble in CAT is usually the result of entering it unexpectedly at too high an airspeed and with passengers' belts not fastened. The high speed entry puts excess stress on the airplane structure and on the human occupants. On the other hand, in most airline transport penetrations of thunderstorms, ample warning is available and advance preparations have been made. In these cases, even though the element of surprise is missing, records show many loss of control incidents. Upsets are almost always around the pitch axis.

Different as CAT and thunderstorm turbulence are, flight through both types of rough air calls for similar piloting technique. The best illustrations of what a pilot is asked to do with his airplane in turbulence come from a study of thunderstorm flying.

Buffet Boundaries

Excellent articles on the high altitude performance of jets have received wide circulation. The substance of these articles is that an airplane can get either a low-speed or a high-speed buffet. When it occurs at low speed and a high angle-of-attack, it is known as stall buffet. When it occurs at high speed, it is called Mach buffet and is associated with air moving over the wing at the speed of sound. Each buffet indicates airflow disturbance over the airfoil which seriously affects its efficiency.

High and low buffet speeds are far apart at low altitudes, but at high altitudes they converge at the "aerodynamic ceiling" of the airplane. At this altitude, with normal 1-G loading, there is airflow disturbance over the wing associated with stall buffet; and at the same time there is airflow disruption associated with Mach buffet. The altitude level just below the aerodynamic ceiling of the airplane has been nicknamed the "coffin corner." When operating in this high altitude area, very little variation from target airspeed, or increase in normal 1-G loading, can cause the airplane to buffet from penetration of one of the buffet boundaries. Obviously this fact must be considered in flight planning in areas of forecasted turbulence.

Proper Technique

Target Airspeed—The manufacturer has expended much effort in arriving at the proper airspeed to be used in turbulent air. The figure furnished to the pilot is the best compromise between the high-speed, good-control, maximum-stress entry and the low-speed poor-control, danger-of-stall, minimum-stress entry. During the period of my research, I have seen a move toward slightly higher penetration airspeeds which speaks well of the structural integrity of the airplanes being flown.

Preparation for Entry—Prior to entry into rough air, if in the climbing or descending phase of flight, the climb or descent angle should be reduced. Better still, level flight entry at the target airspeed recommended by the manufacturer is preferred. The airplane should be trimmed for neutral control forces around all its axes. The level flight pitch attitude should be noted for further reference. Power should be set to a value which in smooth air would produce target airspeed. Lighting should be adequate, loose articles secured, crew and passengers battened down. There should be a clear understanding of crew duties.

Attitude Control—Entry into a thunderstorm can bring violent gusts from any quarter. No amount of experience can tell the pilot from whence cometh the next gust. The pilot's primary attention should be given to keeping the pitch attitude close to the previously referenced point for level flight at target airspeed. This level flight pitch attitude should be maintained in a soft manner by smooth control movements, as contrasted to rigid attitude control with large, fast control movements. The cockpit instrument showing pitch attitude is the artificial horizon. It is the most valuable of the flight instrument group.

Airspeed Control—The proper theory on airspeed control is that pitch and power changes should be kept to a minimum. If this is done, the airspeed may temporarily fluctuate with gusts, but no undesirable trends will be set up. The gusts will tend to decay or reverse, and balance out with no harm done. Only after an undesirable persistent airspeed trend is set up should small power and attitude changes to stop the trend be made.

Altitude Control—Mentioned last, and unless

terrain clearance is a problem, least in importance is altitude. If it is difficult to maintain attitude, airspeed and altitude, the first expendable should be altitude. If attitude and airspeed are under control, small corrections may be made toward the desired altitude.

The Problem

Where does the problem develop which has resulted in so many out-of-control incidents and accidents? Is it in instrumentation, airplane stability characteristics, structural strength, pilot training or other human factors? The true answers must be found and made known.

Indication of Two Patterns—There was an outbreak of jet upsets in turbulence in 1962 and 1963, prompting massive research into the problem. Though not so well publicized, there were similar upsets occuring in the early 50s involving propeller-type airplanes. In 1955, I wrote of a pattern evident in the upsets occurring at that time. An understanding of the upset pattern in the 50s will assist us in analyzing the more recent jet incidents to see if there is an obvious pattern.

Source of Research Data—The following information was gleaned from a large file of incident and accident reports accumulated from many sources in the last 12 years. It is impossible for me to reproduce these voluminous reports and, furthermore, many are marked confidential. Many have been given to me orally, with no desire for publicity.

Because much of the data referred to here cannot be revealed, I ask you to explore my theories and reasoning and then examine reports available to you from your own sources.

Part I—An Analysis of Loss-of-Control Reports Involving Propeller-Powered Aircraft in Thunderstorm Type Turbulence.

Significant Factors—The propeller-powered airplanes involved did not have a movable horizontal stabilizer. They had very effective elevators, with an ability to change pitch attitude rapidly.

The engines were in the same horizontal plane with the center of gravity. These engines had much aerodynamic drag.

There was much wing area compared to weight, i.e., the wing loading was low. The wings had little sweep back, being essentially straight.

The following synopsis is representative of a typical incident.

Conditions Before Entry—Prior to rough air

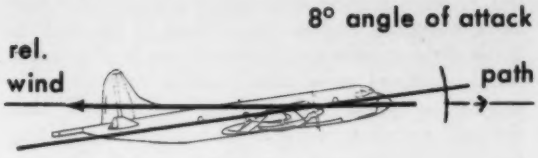


Fig. 1. Level flight in stable air at reduced airspeed, airplane mounted arrow indicates relative wind source.

entry, airspeed was reduced, and nose eased upward to maintain level flight. Thus entry was at an angle-of-attack higher than that used in cruise configuration. Power was stabilized. (Figure 1)

Updraft Entry—The airplane entered a severe updraft which radically increased its angle-of-attack. At this time a statically stable airplane would have started to pitch downward, but this was not shown

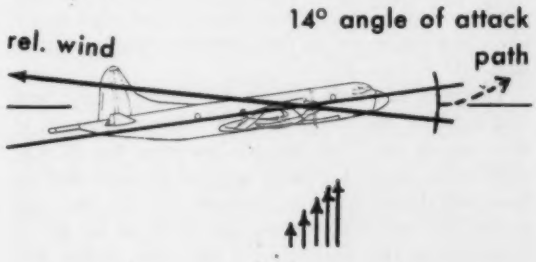


Fig. 2. Updraft entry, heavy positive G, low airspeed.

in any of the reports. The flight path curved upward in the updraft. The positive G load increased materially. Temporarily the flight path and the relative wind were not directly opposite to each other. (Figure 2)

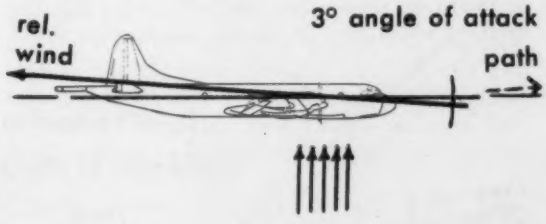


Fig. 3. Updraft continues, forward stick lowers nose rapidly, small positive G, low airspeed.

Pilot Response—Pilot reaction, invariably, was to use heavy forward stick opposing the updraft which was boosting the airplane above its entry altitude. (Figure 3) There has been much specula-

Continued

tion in some quarters as to pilot reaction at this time as he interprets various control cues in the cockpit. Much of the speculation, it seems to me, is ill-founded. In my opinion, *every pilot's initial reaction* when entering a violent updraft *is to use forward stick*, the only variation being as to how much and how fast it is applied, and how long it is held. The predominant control cue here is the heavy positive G acceleration. Positive acceleration is mentally associated with a nose-up pitch attitude, a steep climb, and a subsequent decrease in airspeed. The pilot initially reacts with nose-down controls.

The forward stick application was continued to the full forward position and was held there. (Figure 3) At this point the positive acceleration coming from the steep gradient updraft outweighed the negative acceleration normally associated with a rapid nose-down pitch progression, leaving a net G load acceleration on the positive side. If attention had not been paid to the artificial horizon, the pilot would have been unaware of the nose-down pitch progression.

The pilot had used controls to lower the nose, and had actually succeeded, but he *felt* no response to this control use. This led to continued use of forward stick. Early models of artifical horizons had no blue and black coloring representing the sky and earth. The artificial horizon was likely to be misinterpreted in this maneuver if the pilot, being preoccupied with the rapidly increasing altitude, high rate of climb, low airspeed and seat-of-the-pants feel, returned to see it showing a large pitch displacement nose down.

Draft Cycles—In a short period of time, one of three things would have taken place as to vertical air movements within the storm. The updraft may have continued, in which case the airplane would have continued its acceleration until stabilized within the draft, at which time its positive acceleration would have ceased. A second possibility is that the airplane flew out of the updraft into relatively calm air, which again, removed the positive acceleration previously present. The final and most serious possibility is that the airplane flew out of the steep gradient updraft and quickly entered a heavy downdraft. A draft reversal is assumed to have occurred in the typical incident. (Figure 4)

Negative Angle-of-Attack Stall—If this draft reversal came as full forward stick was being held, it brought about a situation not familiar to some pilots. This new situation was a negative angle-of-attack stall, evidenced by buffet simultaneously with a heavy negative G load and also *decreasing* airspeed, even though the airplane's pitch attitude was nose down. (Figure 4)

The negative acceleration reported by pilots was confirmed by a mass of other evidence. Passenger arm rests were pulled loose and thrown to the ceiling along with other debris. As oil went to the top of the oil reservoir, there was oil starvation at the oil pumps, and a loss of oil pressure to the propeller dome allowed the blade-pitch angle to flatten and caused propeller overspeeding.

Concern With Airspeed—The negative G load being pulled should have been a strong cue to get off the full forward stick, but at this time the pilot wanted more airspeed and sought to get it by continuing to push the nose deeper into the dive. This forward stick kept the airplane in a negative angle-of-attack-stall. The heavy drag present prevented an airspeed increase even against the pull of gravity.

Recovery Dive—Finally, recovery was made visually by pulling back on the stick after the airplane flew out of the clouds in a deep-dive attitude. Airspeed built rapidly as soon as forward stick was released. (Figure 5) Some recoveries were made with back stick even though still flying "on instruments." The back stick brought about a streamlined,

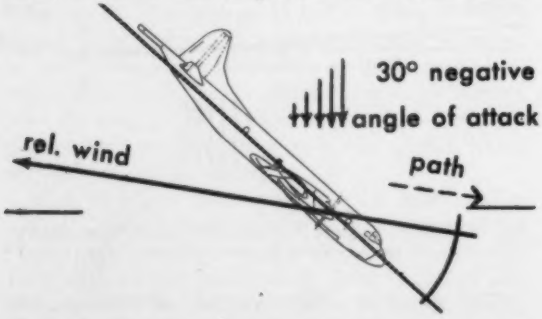


Fig. 4. Downdraft entry, full forward stick, negative angle-of-attack stall with low airspeed.

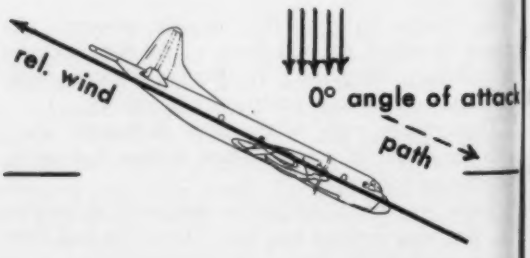


Fig. 5. Back stick and stall is broken, airspeed increased rapidly in streamlined dive.

low-drag dive and full recovery with a very high airspeed.

The pilots with complete knowledge of the phenomena just discussed are aerobatic pilots who have experimented with the unusual negative-G type maneuvers such as outside loops, outside snap rolls and inverted spins. These aerobatic pilots know you can stall an airplane, positively or negatively, from any pitch attitude, by aggravated control use.

In comparing the suggested pilot technique with the typical report just discussed, two major points stand out. Full elevator was used for nose-down pitch, and a large attitude change later became evident. Even though center line thrust was available to help control airspeed no use was ever made of it.

Summarization—The propeller-powered airplane upset pattern involved:

1. A high angle-of-attack entry.
2. Flight into a strong updraft.
3. A rapid upward acceleration, with heavy positive-G loading evident.
4. A gradual trend toward a lower airspeed.
5. The use of full forward stick.
6. A rapid nose-down pitch progression.
7. Flight into a strong downdraft (assumed only).
8. A negative-angle-of-attack stall, with negative-G loading present, and with buffeting.
9. A continuing lower airspeed trend.
10. The use of back stick.
11. The immediate build-up to a very high airspeed.
12. Recovery from the steep dive.

Part II—Jet-Powered Transports in Thunderstorm Turbulence.

Significant Factors—The elevators installed on jet-powered transports do not provide the high rate of pitch change capability found in propeller-driven aircraft. The elevator effectiveness ratio between jet and propeller-powered airplanes is reported to be as low as 1/3 to 1/7 in some flight regimes.

The jet airliner has a slow moving, motor-driven horizontal stabilizer which also controls movement around the pitch axis. This stabilizer is about four times as large as the elevator.

Most jet engines are located below the wing and, thus, well below the horizontal plane of the center of gravity. Obviously power changes would bring pitch changes.

The jet airplane wing is swept back with a comparatively small wing area relative to its gross weight resulting in high wing loading.

Conditions Before Entry—Virtually every jet upset has started while in the climb portion of flight. Each airplane had a moderately high angle-of-attack, and power was stabilized (jet upsets began in climb).

Updraft Entry—Once again trouble starts with a violent updraft. The positive acceleration is heavy as the climb path becomes even steeper. The angle-of-attack increases materially.

Pilot's Response—Again the pilot's reaction was to use full forward stick, and in the jet aircraft he followed up with the motor driven stabilizer to help lower the nose.

Possible Temporary Static Instability—A new element is introduced into the pattern here. The considerable evidence available to me indicates that the jet transports involved *actually pitched upward*, slowly, but persistently. This indicates *static instability* as the airplane is *not* acting as a weathervane around its pitch axis. The static instability could be related to either of two aerodynamic changes in progress at, or near, the wing tip.

The outer portion of the wing is flexing upward under the positive acceleration and concurrently is twisting to a lower angle to the relative wind. The wing tip thus has a lower angle-of-attack and produces less lift. This is called tip unloading. If the updraft is severe, tip unloading might be followed by tip stall. This tip unloading/tip stall occurring on a swept wing moves the "center of lift" forward and the airplane slowly but persistently pitches upward. If the tip stall progresses inboard to envelop the entire wing, the pitch-up ceases. Flying out of the updraft also could change the pitch-up trend. Airline pilots have been taught that their jet airplanes are statically stable. Evidence does not indicate this to be correct under severe gust loading.

Now back to the airplane in turbulence trouble. The pilot was using the elevator and stabilizer to attempt to lower the nose in the updraft. The persistent pitch-up possibly from the *static instability* just discussed, leads the pilot to continue using the stabilizer to lower the airplane's nose. Finally, the nose does slowly respond, nose downward, the stabilizer having been used to its limit.

Early Portion of Dive—As nose-down rotation continued the jet started a fast speed buildup. Please remember that, the *rate* of rotation, nose downward, had been slow in the jet; the fuselage centerline stayed approximately parallel to the flight path as both turned downward. The aerodynamically clean jet in a streamlined dive accelerated rapidly. (The fuselage centerline and flight path had *not* been parallel in this part of the prop-type upset pattern.)

Stabilizer Mistrim—The newer artificial horizons are much less likely to be misinterpreted than the early models. The pilot quickly recognized the dive attitude and pulled back on the stick to bring the nose up. The airplane now was in a heavy mistrim situation. The slow moving stabilizer was at its limit asking for the nose to pitch *downward*, and the quickly moved elevator was at its limit asking the nose to pitch *upward*. This mistrim situation coupled with a high airspeed could have caused the stabilizer drive mechanism to stall and thus be unable to move the stabilizer from its extreme position. The stabilizer has been found in the *full* nose down position in several fatal jet transport accidents.

Suggested technique to handle the mistrim situation is to relieve the elevator pressure opposing the stabilizer, and then the motor is able to move the stabilizer. In the upsets much altitude was lost as this was being attempted.

Where recoveries have been completed, they have always been from steep dives.

Summarization—The jet-powered airplane upset pattern involved:

1. A high angle-of-attack, *while climbing*.
2. Flight into a strong updraft.
3. A rapid upward acceleration, with heavy positive G loading evident.
4. A gradual trend toward a lower airspeed.
5. The use of full forward stick.
6. A nose pitch-up progression.
7. The trimming of the stabilizer to its full limit in the airplane nose down direction.
8. A *slow*, nose-down pitch progression.
9. Flight into a downdraft (assumed only).
10. A *very small* negative angle-of-attack.
11. A rapid airspeed buildup, *early* in the dive.
12. A delayed recovery from the dive complicated by a *massive mistrim* situation.

Concluding Remarks

Early in 1964, two things were done which contributed significantly to the dramatic decline in incident reports since that time.

First, the pilots were taught to use *no stabilizer* after having trimmed neutrally prior to entry into turbulence.

Then, several jet airplane models *were* modified to reduce the amount of airplane nose-down stabilizer available to the pilot from his pickle switch activated motor.

No answers *have ever been supplied* as to *why* all pilots have used heavy nose-down trim in all significant turbulence upsets.

Could the answers be that there was a violent updraft and each pilot opposed it with nose-down elevator? Also, was there not a pitch-up in the updraft and did not each pilot oppose this with nose-down elevator and stabilizer? The stage was then set for the draft reversal and the massive mistrim problem.

When the gust, airplane and human contributions to oscillation around the pitch axis are timed together, the oscillations can easily become large and divergent, rather than dampened and harmless.

The most immediately productive area for improvement has been, and still is, in pilot knowledge and training. Once the upset problem is more fully understood certain modifications can be made in the training programs.

Much attention has always been given to design for stability around the pitch axis in all airplanes. The tapered, swept wing has intensified the problem of early tip stall, which greatly affects pitch stability. Terms such as slots, wing fences, washout, and so forth are familiar to manufacturers. This whole area is interesting to study as new jets come out with aft mounted engines and the high "T" tail. I must leave the design to aerodynamicists and concentrate on flying the machine.

Acknowledgement—Many people, in all branches of aviation, assisted in the work just outlined. Because portions of my message are controversial the individual contributors are not listed. The pilots who have submitted incident reports have been the real key to much progress being made.

Inverted Spin

Being half right won't always salvage the rest of your day. It was close in the case of a student pilot flying a TF-9J in simulated combat maneuvers.

"The crash followed a post-stall gyration and inverted spin from FL 220. The stall/spin resulted from applying negative G to the aircraft when it was pitched up at a 100-degree nose-high attitude, wings level, with the airspeed decreasing to 0 kts. . . ."

As the student pilot pushed forward on the stick in an attempt to make a zero G recovery, the aircraft settled back to 120 degrees nose-up and the right wing began to drop. A nose-high, inverted attitude, with forward stick applied into the negative G area are classic conditions for a spin entry. At this point observers in the flight noticed the characteristic stream of white vapor exit the tail pipe, indicating that the aircraft was at zero G or less. Predictably, the nose continued to fall through, the wings rocked uncontrollably and the aircraft entered an inverted spin.

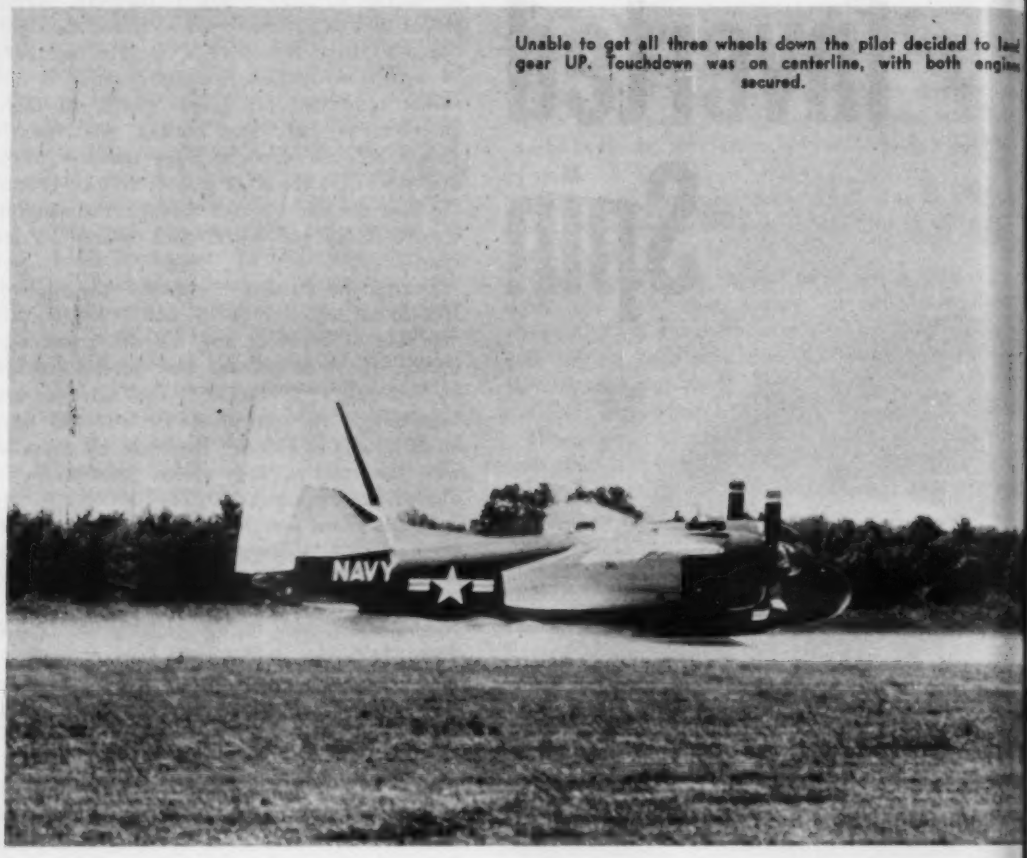
During the attempted recovery, the student pilot focused his attention on the ball as an indication of direction of rotation, and did not notice the turn needle. He "checked the ball out to the left and applied full right rudder." The reaction was disheartening. "The spin slowed for a second, then went on as rapidly as before." He made one more attempt with the rudders, then ejected successfully as the aircraft passed through 5000′.

In analysis it was determined that the direction of rotation was clockwise when viewed from above, with the left wing of the aircraft to the inside of the spin. In this situation the application of right rudder was correct, being in the anti-spin direction. *The pilot's error at this point was not in the rudder he used, but in the reference he used to determine which rudder to apply.* Since the ball can be in any position if there are unusual variations in side forces during a spin, *the turn needle is the only consistently correct spin direction reference instrument.* His use of right rudder probably accounts for the momentary reduction in rotation rate. It is probable that the ball and the needle were both out to the left during the spin, but the pilot's effort to achieve enough rudder throw to counteract it was inadequate because he was being forced upward in the cockpit and away from the pedals by negative G.

An endorsement probably lent to the pilot's chagrin by stating that, "There is nothing in this accident to suggest that the pilot would not have recovered had he applied proper spin recovery controls, *and held them.*"

It concluded that, due to the rapid loss of altitude inherent in uncontrolled spins, (about 2500′ per turn—each complete turn lasting from 2 to 4 sec) "it should be stressed that recovery attempts below 10,000′ can only place the pilot's life in danger. *Initiation of the ejection sequence at a minimum altitude of 10,000′ when the aircraft is not under control cannot be overemphasized.*"

(For a treatment of spin recovery techniques, see "Spinning and Winning," APPROACH, December 1966 p. 12.)



Unable to get all three wheels down the pilot decided to land gear UP. Touchdown was on centerline, with both engines secured.

THE PROFESSIONAL APPROACH

There are no substitutes for crew coordination and sound pilot procedures. . .

It can really make a difference—to you and to me as taxpayers, for one thing—when a pilot takes the professional approach to his job. Good, sound pilot technique constantly insures a measure of personal safety for pilots and crew, and can sometimes help to minimize damage to the aircraft when some sort of bending is inevitable. Inattention, or lack of application, on the other hand, can often pave the way for an untimely and costly accident.

The results of two similar situations are shown in the accompanying photographs. One ended as an incident, the other as an accident. Even so, damage to one aircraft could have been avoided completely while in the other case it might have been much worse than what actually occurred. The results as we see them, hinged on pilot technique.

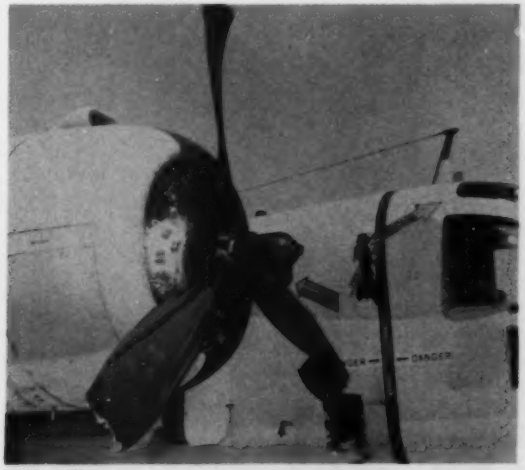
In one case the pilot knew that his wheels were UP. In the other, the pilot assumed that they were DOWN. Knowledge, not assumption, made the difference and luckily, no one was injured in either occurrence.

With minor exceptions, the first incident was a classic example of multi-engine finesse.

Approaching the first of two scheduled stops on a ferry cross-country flight in a US-2C, the pilot dropped the gear for a normal landing. The nose gear and starboard main mount cycled normally, but the port main mount hung up in the well. Inspection and recycling further disclosed that the portside wheel well doors would close normally but they refused to open completely. Hydraulic pressures held within normal limits.

All attempts to lower the gear using positive and negative G, yaws and slips proved futile. The hand pump and emergency system also were ineffective. An attempt to jar the mount down by making a

Damage was held to a minimum. Note the clearance afforded the starboard prop by its having been positioned prior to touchdown.



Quite a difference. Substantial damage resulted from an unintentional wheels up landing at night. Damage to the fuselage occurred when two prop blade ends shattered on touchdown.

touch-and-go landing on the starboard wheel was discarded after a discussion with maintenance personnel from a VS squadron at the field, who reported having had a number of unsuccessful experiences with that procedure. After considering the options, all hands involved finally agreed in the decision to make a wheels-up landing.

Since time was not a factor in determining the outcome, the crew put it to work on their side. They returned to their not-too-distant home field and continued to burn down while they went over in detail the procedures to be used on landing.

The crash crew and the tower were notified of the pilot's intentions, and when the time was at hand, the crash trucks laid a foam strip 24′ wide and 2400′ long on the duty runway.

With the crew thoroughly briefed and ready, the pilot began a long, straight-in approach. Mindful of the hazard if the starboard prop were turning on impact, the pilot feathered it at five miles. The copilot used the starter to position the blades at the 12, 4 and 8 o'clock positions, hoping thereby to minimize its ultimate contact with the runway. The pilot continued the final approach single-engine.

At the field boundary, holding 110 kts with FULL flaps, the crew jettisoned their hatches. Then, after crossing the runway threshold at an altitude of 30′ and approximately 300′ prior to the foam, the pilot feathered the port prop. Airspeed was 100 kts into the flare, and the copilot quickly positioned the port prop like its mate.

Both props chewed the blacktop until they were worn down and curled back beyond repair.

With both fans standing smartly at parade rest, a gentle, controlled touchdown followed on centerline, 50 to 75′ into the foamed strip. After 1700′ of travel in the foam the aircraft skidded to a stop, all switches were secured and the crew exited without further incident.

Quite a different set of circumstances surrounded the accident, but it serves to show the damage that can result from the more common *unintentional* wheels-up landing.

After completing nine night touch-and-go landings, the pilot under instruction in the left seat of an S-2D began a no-flap approach. As with all their preceding passes, the pilot used the short "bounce" checklist. They were also using an abbreviated, almost circular pattern which allowed the aircraft to arrive at the downwind altitude just a few seconds prior to its reaching the 180.

Caught up in the rhythmn generated by their frequent landings, the copilot dutifully reported, "Wheels DOWN and LOCKED" to the tower for the tenth time that evening. The copilot thought that he had checked the wheels but the pilot later wasn't sure if he had personally done the same. At any rate, on airspeed all the way, the aircraft touched down smoothly on the radome 1400′ down the runway. The nose fell through immediately and both props chewed the blacktop for 800′ before they were worn down, broken and curled back beyond repair. The fuselage continued for 500′ more before it finally came to rest. No fire resulted.

The cause of the accident was attributed to pilot error. By using a short, hurried pattern and not allowing sufficient time to properly complete the required checks prior to landing, the pilot, like the legendary bird, forced disaster on his last pass.

Damage was substantial and the aircraft had to be shipped to a NARF for repair.

The wheel hang-up in the first case was caused by material failure of a horn assembly on the port wheel well door. This might have been the cause of a major accident, but professional performance came through. Investigation by maintenance personnel later showed that the torpedo-bay doors and starboard wing tip needed replacement along with the horn assembly in the wheel well. But the starboard prop blades were only slightly nicked and worn and could be repaired locally. The port prop was undamaged. A bent mirror bracket on the underside of the aircraft and an understandably mangled Fosdick were the only other items of interest requiring repair.

Thanks to a high degree of professional competence, a potentially serious situation was resolved safely and damage was confined to the Limited category.

PREPLANNED EJECTION

At touchdown on what looked like the makings of a good carrier landing, an A-4C pilot added full power and commenced retraction of his speedbrakes. He felt the deceleration effects of a normal arrestment. Instantaneously, like a snapping sensation, the deceleration ceased and he felt the acceleration of a bolter as the arresting hook disengaged from the No. 3 cross-deck pendant.

"I had preplanned to eject in this situation," he later stated, "so there was no decision to be made."

With his right hand he quickly reached for the secondary ejection seat firing handle between his legs, looked to see if he had the handle correctly, placed his left hand on top of his right and pulled as hard as he could.

"I felt that time was the essence of success and that I could not afford even the extra instant necessary to position myself in the seat to reduce the chance of injury from the ejection force. Boom went the rocket seat! I closed my eyes, felt the upward acceleration, a little wind blast and the sensation of rolling to the left. The pop of the chute opening was immediately followed by the wonderful tug of a deployed chute.

"I opened my eyes, released both oxygen face mask fittings and saw that I was slightly above the flight deck level facing the ship. I was afraid observers would panic and perhaps cause another accident so I waved to a flight deck director wearing a yellow shirt to let him know I was all right. I then thought of releasing a harness fitting or inflating my Mk-3C life preserver but decided to leave well enough alone. I gently entered the water and, as I submerged, I pulled both toggles to inflate my Mk-3C.

"Surfacing immediately, I saw my plane pointing toward me about 50′ ahead with only the tail sticking out of the water. White smoke or steam was escaping from the tailpipe and debris which appeared to be part of the drop tanks and nose section was floating nearby. The plane sank rapidly. A dye marker actuated automatically and turned the sea yellow all around me and my chute lay streamed and collapsed behind.

"Disengaging the upper Koch fittings and the lower rocket fittings on my torso harness freed me from my parachute and I started to swim slowly away from it. I noticed someone on the LSO platform as it went by and I stopped swimming long enough to give him a thumbs-up. As the stern of the carrier passed, I looked down the wake and saw a destroyer coming more or less in my direction. At this moment I felt the rotor wash of a helicopter overhead. I lowered the visor of my helmet to protect my eyes from the spray and, looking up at the helicopter, waved it away even though the rescue seat was within my reach. I thought that I might be entangled in the chute or too close to it for a safe recovery. I didn't want anything to spoil my day. I got out my chest-mounted knife, and thrashed around in the water looking for something to cut but couldn't find anything.

"Then I started to swim further away from the chute. After several strokes I stopped and the helicopter returned. In getting on the rescue seat somehow I managed to get my leg over the hoist cable. The operator saw my situation and stopped the hoist so I could get disentangled. I sat on the rescue seat with both arms wrapped around the shank. The hoist operator then began to raise me out of the water, the rescue seat spinning slowly. I did not let my knife drop until I was near the helicopter hatch; I held on to it just in case.

"Without help from me, the helo crewmen pulled me through the hatch and into the helicopter. When I had reported aboard the carrier earlier this year I had been briefed by the copilot of the helicopter on the rescue phase and the rescue was effected exactly as he had briefed."

Investigating flight surgeon's comments: "The pilot's reactions were exact and prompt, the ejection sequence went according to the best expectations and the recovery was effected exactly as briefed by the helicopter squadron. This evolution is an excellent example of the advantages to be gained by constant and attentive training in escape and rescue procedures."

EVERY AIRPORT IS DIFFERENT

....but accidents remain the same!

The evolution of airport design seems to have followed no discernable pattern. Influential circumstances are varied, some of which are: Land availability, topography, funds on hand, prevailing winds and volume of traffic expected. In short, no two airports are exactly alike.

Takeoff and landing accidents encompass a great part of naval aircraft damage. Few are identical and it seems to be almost impossible to foretell every cause in advance.

One such unusual takeoff accident recently occurred to a TF-9J. The airport location was about ¾ of a mile high and the temperature was 88°F. The pilot performed all of the necessary calculations commensurate with the longest runway available (12,000'). The results stipulated that the plane could not get airborne within NATOPS minimums on even that long runway with the full load of fuel already aboard. Accordingly, a plan was formulated to burn up enough fuel before takeoff to conform with calculations.

The pilot filed an IFR flight plan. Night had fallen but the local weather was CAVU. After getting the engine started, the pilot was directed by ground control to an intermediate location where he could burn off the excess fuel. While lightening his load, ground control further informed him that the temperature had then fallen to 86°. At the end of 23 minutes the pilot ascertained that his aircraft weight was within limits and he requested ad-

ditional taxi instructions. The pilot continued to display concern over sufficient takeoff distance as indicated by his request that he would like permission to use the additional overrun of runway 08. He was then told he could use the 12,000′ of runway 04.

A recheck of the light winds convinced the pilot that the longest runway would indeed be best; and he requested directions to taxi to runway 04. The takeoff end of the selected runway was shared with runway 35 (7000′ long) and then they both fan out in their respective directions from there. Although not embracing the same starting pavement, runway 08 did diverge out from the same general hub area, making it a third lighted runway emerging from the area. To get to the beginning of 35 and 04, the *Cougar* had to follow a westward taxiway and then turn south west to the end of the runways. It is not difficult at night, among the maze of lights at a semi-strange airport, to lose one's bearings over long and turning taxi routes.

Pre-takeoff lists were completed for a flaps-up run and the RMI was in the free DG position. The pilot had computed his roll to be 6200′ lifting off at 124 kts, and if 112 kts were not reached after a 4000′ roll he would abort. After swinging into takeoff position, erroneously on runway 35 instead of 04, he made all of the proper last minute checks except to see if his compass verified that he was lined up on the correct runway.

Full brakes, the fence and a sheared off landing gear brought the aircraft to a messy but flameless rest.

The copilot was asked to call off the runway 1000′

markers. Unfortunately, none were observed and it was a bit naive to think such signs could be seen in the dark at a civilian airport.

After being given his go signal, the pilot heard no more from the tower operator until at about 5000′ of rollout. At that point the tower operator radioed to the pilot that he was on a short runway with very little distance remaining. Obviously, some quick thinking was required. Simultaneous with noting 120 kts on the airspeed indicator, the pilot thought he could see the end of the runway very close at hand. He had passed his selected abort distance and airspeed so that one would assume he could keep going. A sudden glimpse of a 6′ fence a short distance in front but off the end of the runway apparently convinced the pilot that he could not get over it. Full brakes, the fence and a sheared off landing gear brought the aircraft to a messy but flameless rest approximately 200 yds off the runway. The crew emerged unhurt.

The following interesting recommendations were included in a report of this mishap.

"A. That the need for increased caution and meticulous use of checkoff-lists be reiterated to all pilots because of distractions and interruptions of habit patterns caused by the varying modes of operation that are encountered when flying out of civilian airports. In addition that all aircraft equipment such as RMI, compass, taxi lights, and so forth be utilized to keep the pilot oriented in confusing areas, or when doubt exists.

"B. That the NATOPS manual be revised to include no-flap takeoff roll computations."

Several other contributing factors seem noteworthy:

1. The pilot had had little sleep the night before and had been up about 18 hours at the time of the accident.

2. Three lighted runways emerging from the same general focal point, each only 40 and 50 degrees of divergence apart, may confuse pilots who are unfamiliar with runway layout. Most airports only keep one at a time lighted.

In this related vein of odd airports, an accident to an F-8 is considered noteworthy. The pilot had already made five flights from the civilian airport in question and he was returning from the sixth with radio trouble. Light rain was falling at the near sea level location and the temperature was 54°. Although jet airliners operate regularly from the airport, its runway lengths are marginal for military jets. The longest runway is 9450′ but the wind was such that a slightly shorter (8400′) runway was the duty.

The *Crusader* apparently came over the end of the runway on the fast side because it floated over the first 2000′. In essence, this meant that the pilot had 6400′ left for stopping on the bituminous pavement which was wet and therefore slippery.

Touchdown speed was estimated at about 134 kts. Light aerodynamic braking was initiated and at 110 kts the brakes were first applied. With about 2000′

of runway remaining, the engine was secured and the emergency air brakes were actuated. After the aircraft went off the end of the runway, the fuselage and the left landing gear struck two lights of the first row of approach lights shearing their supports. *The F-8 then went over a 20′ embankment, coming to rest against an approach light tower 400′ from the end of the runway.* Again, the pilot emerged unhurt.

The pilot later stated that he considered "going around" when initial braking produced no apparent deceleration but then elected to remain on the ground because his airspeed was 100 kts and he was unsure of the amount of runway remaining. The NATOPS flight manual states; "At normal landing gross weight, elect to go around when speed is in excess of 105 KIAS with 4000 ft of runway remaining."

The pilot erred in not requesting the longer runway; not touching down sooner on the pavement; not going around for a better approach.

Here are two accidents at non-naval airfields. Both of them could have been prevented, most certainly, if emergency arresting gear had been installed. It is questionable if runway distance markers would have been helpful in making sufficiently quick decisions to save both aircraft.

The F-8 went over a 20-foot embankment and came to rest against an approach light tower.

The lesson of this story is that pilots must know their type airplanes and fit them to the airport they intend to use. If it is a bad fit, make other plans where the equation furnishes acceptable answers.

Short Snorts

30-Degree Pop-up

A division of four *Skyhawks* was conducting bombing practice. Pilot X, the second section leader, had been asked by the maintenance chief, before departure to make a special inflight check of the A-4B's gyro. Accordingly, upon completion of the primary mission, Pilot X radioed the division leader concerning the requested test. Summarily, Pilot X was given permission to detach and conduct the necessary maneuvers. Upon overhearing the conversation, the second section wingman (Pilot Y) asked if he should stay with his leader. Pilot X said yes and informed Pilot Y that he was going to perform a 30-degree pop-up maneuver. Pilot Y acknowledged and stayed with his leader.

During the rolling stages of the test, Pilot Y began to overtake the leading A-4B. Going over-the-top and into the inverted part of the maneuver, the slow speed caused Pilot Y's controls to become sloppy and he could not prevent his inflight refueling probe from gouging the under side of Pilot X's starboard aileron. Further impact was avoided and inflight safety checks revealed a safe landing could be made. Both aircraft were recovered without incident.

Investigation revealed that Pilot Y was over zealous in trying to fly close formation throughout the maneuver. Pilots must realize that when performing a weapons delivery, timing and close attention are required. Close formation in this case is diffiicult, unnecessary and can detract from accurate ordnance delivery.

Landing Troubles

An experienced pilot was being checked out in an A-4B. After the familiarization flight, he made five touch-and-go landings on a neighboring airport. The runway was 12,500 ft long.

The longer runways at homebase were closed for repairs. The only available strip was 5091′ long and it was equipped with morest. Enroute to homeplate for the final landing, the pilot and his leader in another A-4B agreed by radio that they would not use the morest if the headwind component down the runway was 12 kts or more. Subsequent conversations with the tower operator indicated a crosswind of 16 kts slightly off the duty which angled and produced a component wind of 12 kts down the runway. A normal landing with 2100 pounds of fuel aboard was initiated, with flaps fully extended.

The *Skyhawk* crossed the runway threshold at an estimated 125 kts. Upon touchdown, the pilot deflected the control stick into the wind and commenced braking. During the roll out, the starboard tire blew causing the aircraft to commence a right swerve. Corrective action caused the port tire to blow out. The pilot was now unable to hold the aircraft on the pavement and it went off the starboard side, the right wheel striking a runway light mounting. The resulting impact broke the MLG mount and it trailed aft. The *Skyhawk* came to rest on the port wheel and starboard external drop tank 50′ off the right side of the runway and 3700′ from touchdown. The pilot was not injured and no fire resulted.

The NATOPS Pocket Check list in the possession of the pilot indicated that the landing could have been made, with flaps up, in 3185′. Consequently, the board concluded the incident was primarily caused by improper pilot landing and braking techniques. Secondarily, supervisory assistance was lax in not recommending use of the morest emergency stopping gear.

BLC Malfunction

During climbout in an F-4B the pilot noted a flashing WHEELS light on his instrument panel. He immediately slowed the aircraft to 200 kts and selected flaps FULL DOWN. When nothing happened

he checked the circuit breaker panel, found the flaps circuit breaker popped and reset it. Still nothing happened. The pilot then promptly lowered the flap using emergency procedures and made an uneventful morest landing.

Investigation later revealed that a boundary layer control valve had failed internally and ruptured a BLC control seal assembly. As a result engine bleed air was directed onto the flap. Extensive heat damage was probably averted by the pilot's prompt and positive action.

The pilot's commanding officer commented significantly that, "In an addition to the NATOPS Manual dated May 1966 the information first appeared stating that a flashing 'Wheels' light with flaps and gear indicating UP, should be treated as a boundary layer control malfunction. It is also interesting to note that during the F-4B NATOPS conference in August the possibility of deleting this late addition was discussed and rejected. It is only because of this addition to NATOPS that the flight crew rapidly recognized this light as a BLC malfunction and took proper remedial action immediately."

Dual Incident

Shortly after takeoff in an EA-6A the pilot and crewman heard a sound they described as a "rushing of air" and almost simultaneously, the starboard engine fire warning light illuminated. The pilot reduced power on the engine indicated, turned back to the field and began dumping fuel. The warning light didn't go out, so the pilot informed the tower of his difficulty and requested an immediate landing. He dropped the gear on the downwind and found an additional problem when the nose gear settled on barber poles.

Recycling the gear failed to produce a safe indication, and after discussion with squadron personnel and a review of NATOPS procedures with the ODO over base radio, the decision was made to leave the gear handle down and to blow the nose gear DOWN using the emergency extension system.

This procedure failed also and the pilot finally turned to a field arrestment in order to get the bird on deck with a minimum of delay.

The approach was flown with an LSO standing by. The aircraft touched down nose-high, in good position for the arresting gear. The pilot lowered the nose wheel to the runway just short of the wire and engaged the morest at 90 kts. The aircraft came to a full stop and as it did the nose gear finally collapsed. The pilot secured the engines and both he and the crewman exited the aircraft safely.

It was later determined that the fire warning light was caused by the failure of a clamp securing the engine cross-bleed air line to the CSD. The failure allowed hot engine bleed air to circulate through the engine bay, and it ultimately activated the fire warning system. Cause of the nose gear malfunction was entirely separate and involved malfunctions in a flow regulator and priority valve.

Rice Strength

A CH-46A helicopter was engaged in a humanitarian flight delivering bags of rice to outlying villages in Vietnam. Such bags always leak bits of their various contents and rice is no exception. Moreover, rice when dried, is quite hard. This particular model helicopter has a hydraulically operated ramp which usually receives a lot of exercise during the many required stops. Ultimately, sufficient rice wedged in the door crevices so that one more grain was "the straw that broke the camel's back." There came a time when the door would not completely close and after several efforts, it was reopened and investigated. Bits of rice had packed themselves into a fulcrum near one of the ramp hinge fittings and the compressed rice finally reached such magnitude that the leverage in closing the door broke the hinge fitting. Charity missions had to be suspended until the rice was cleaned from the aircraft and the hinge replaced.

Who would have thought that the staff-of-life (to the oriental) could build up such mechanical strength.

Bowser Adrift

As a flatbed truck with an oil bowser on the bed approached an SH-3A from the rear, the bowser fell off the truck. The driver immediately stopped, pulled the emergency brake and placed the gear shift in neutral (he thought). He jumped out of the seat and went back to retrieve the bowser, which by now was pouring oil all over the ramp. Almost immediately, the truck began to roll forward under power and although he tried, the lineman was unable to stop it before it caused limited damage to the helo.

Investigation disclosed that in his rush to retrieve the bowser the driver had placed the shift in third gear instead of neutral; the emergency brake was not in working order; and to top it off, the driver himself was neither licensed nor qualifed to operate yellow equipment.

DON'T GAMBLE. Know your emergency procedures.

Anymouse Special

Incident—Pilot Error

"It can't happen to me; I'm experienced, well disciplined and considered a professional by my seniors, my contemporaries, and most important, by myself." That, I believe, adequately sums up the belief most Naval Aviators have in themselves.

Pilot error is something that surrounds us but hopefully always happens to the other guy. We try to repress any thought of it happening to "number one," but when that day does arrive and we become involved with pilot error, we are forced to take a long realistic look at ourselves and our profession. I think most pilots honestly believe that they are more immune to pilot error than are their contemporaries. This belief is developed through experience and a vivid realization of their personal aeronautical abilities.

Every pilot knows his own capabilities best and with this knowledge he produces the self-confidence he needs to fly. Without it, no aviator would ever take to the air, and yet, almost every week we read about pilot error accidents. For these pilots it's too late; they were caught by their own doing, or so we would like to believe. But actually, how many of these pilot error *accidents* were preceded by similar pilot error incidents? Many, I believe. There is much to be learned from all pilot error incidents, for they give both aviation safety and the pilot a second chance. A chance to find the cause, and hopefully to prevent its recurrence in the form of an accident.

This account is about an incident caused by pilot error. The type of error where the pilot corrects his mistake, perhaps late, but in time to prevent a serious accident. You know, that close one where your pride was the only casualty, and you hoped no one was looking. Academically, an incident is as dangerous as an accident. The only difference is that the incident is not permitted full development into an accident, *but it still contains all the potential it needs.*

If additional emphasis were placed locally on reporting and reviewing all pilot-caused incidents, we should be better able to prevent similar pilot-caused accidents. All incidents, no matter how minor they may seem at the time, must be reported to the cognizant ASO; that especially includes the pilot error type. Deep down every pilot knows how many undetected or unreported goofs he has made in his flying career, and each time he swears never to repeat the same blunders. Hopefully, my incident might prevent another S-2 pilot from a similar situation and in general, cause a little soul searching by all Naval Aviators who read it.

It was a beautiful winter's day in Corpus Christi, warm and clear. My students arrived at 0600 for their brief, quite eager for their second flight in the TS-2A. Today was the day they were going to do the flying

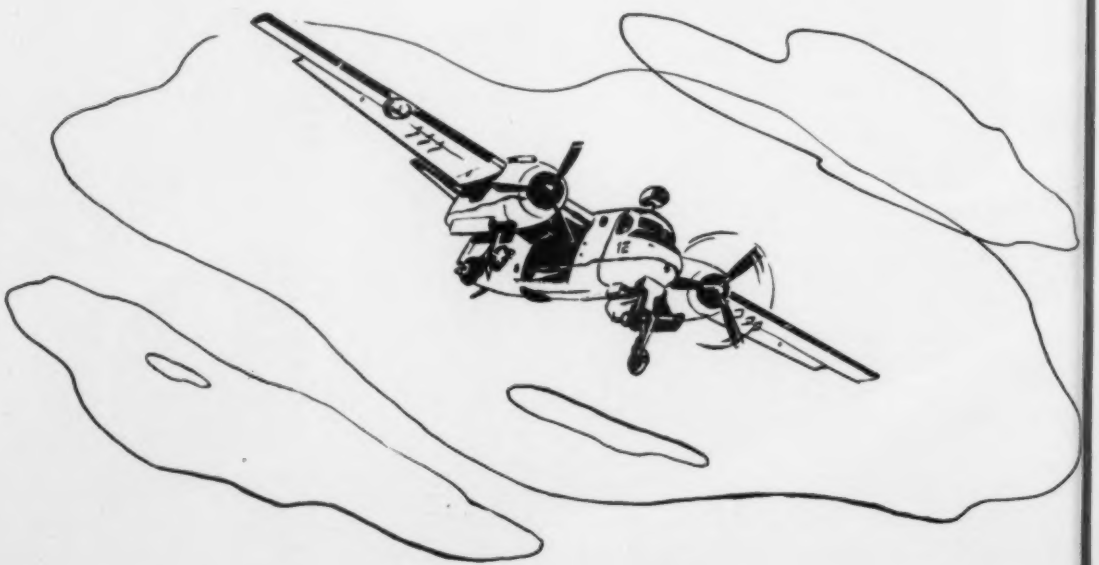
DANGER
DANGER

I was satisfied we had fuel and figured the fuel gages were probably in need of calibration; it was not a big thing and we took off.

including their first attempts at landings. Everything proceeded normally until power plug-in for start. At this time I noticed that the starboard fuel quantity gage read 150 lbs higher than the port. This in itself is not too uncommon, since a mech will frequently run-up one engine and then not order a fuel truck to top off the partially used fuel tank. After completing our engine run-up and prior to takeoff, I questioned the student who had preflighted the top of the aircraft, which includes a visual inspection of both fuel tanks. He reported that both sides were almost equal and he could see fuel in both filler necks. He did not remember the port tank being any appreciable amount lower than the starboard. I was satisfied we had fuel and figured the fuel gages were probably in need of calibration; it was not a big thing and we took off.

After two hours of familiarization work at altitude, I noticed the starboard fuel gage now read 220 lbs higher than the port. Both engines had been operated at the same power settings and the cabin heater had not been used. (The cabin heater only draws its fuel from the starboard side.) I now figured that the port engine was running a little richer than the starboard. This in itself is little means for concern on a local training flight; there is always plenty of fuel. A few minutes prior to letdown in order to join the touch-and-go pattern at home field, I decided to crossfeed both engines off the higher starboard tank. My intentions were to even them up prior to arriving at home field for landings. This being my student's first attempts at landing, I wanted the aircraft to be as closely trimmed as possible. They would have enough to distract them besides trimming for a heavy wing.

When we joined the landing pattern it was nearly saturated and rather extended. The wind was only 10 kts, but it was 50 degrees right of runway heading. This tended to blow many of the aircraft wide at the 180. It was difficult to keep a tight pattern and show the students the correct abeam position since most of the aircraft in front of us continually drifted wide due



to the crosswind. I completed the first student with six landings and we departed the pattern. The students switched seats and then we rejoined the pattern to complete the other student. I noticed after the student switch that the starboard fuel was now several hundred pounds lower than the port, but nothing registered. I had completely forgotten about crossfeeding and I was rapidly developing a rather distinct distrust in those fuel gages. First the starboard was higher, now the port. I decided to keep a close eye on them and we continued with the touch-and-go landings. The stage was set.

On the downwind leg for our fifth landing with the second student flying, I noticed the low warning light illuminate on the starboard fuel gage. (This light is activated when the gage indicates a preset low amount and is not an independent indicator of quantity. I knew this fact and was not too alarmed when it came ON, though I must admit, it does make quite an adverse psychological impact.) I visually checked my side for any signs of a fuel leak and found none. I closely examined the fuel pressure, both with and without the aux pump. It held constant in both cases. By this time I was sure the starboard fuel gage was faulty and possibly even the port. I made a note of this fact on my knee board for the "yellow sheet" write-up at the completion of the hop. Only two more landings were required to complete the flight. We were in the home field bounce pattern which seemed safe enough. Deep down though, I remember feeling a little uneasy and wanting to land, but . . . I sure wanted to complete too.

Approaching the 180 on our last landing I was told by the tower to take interval on another S-2 that was considerably wider than we, due to that crosswind. I took the aircraft from the student and set him up behind our wide interval. This also made us very wide and then deep. *As we approached the 90 the starboard engine failed.* It just quit and windmilled out there without even a sputter. I took the aircraft from the student and feathered the starboard prop. I raised the flaps from FULL to two-thirds and left the gear DOWN. I declared an emergency with the tower and continued the approach with the port engine. I remember checking my altitude and we were descending through 800 ft. An estimated 10 seconds later the *port engine started to cut in and out, and then it too just windmilled.* I was way too deep in the groove to even make the field boundary in a glide. Besides, a *Stoof* doesn't exactly glide with one feathered, one windmilling, and dirty. I declared a Mayday, (the first in my life) and continued. It was not until this very instant that I remembered the crossfeed, and I am sure the Good Lord reminded me. I reached up and selected, "left tank to left engine," closed the throttle to prevent a backfire and/or overspeed and waited. Our altitude was now somewhere between 300 and 400 ft. After what seemed like an hour but must have been closer to 3 or 4 seconds, I slowly opened the port throttle. I expected to hear the biggest bang in the world, but none came. I could feel the increase in rudder pressure and heard the noise; it was running again. With the port engine back on the line, I smartly added full power and continued on to a successful single-engine landing. Now, safely on the deck, the worst was yet to come. I had to tell the C.O. what happened; I was the squadron's Aviation Safety Officer.

The immediate and obvious cause of my incident is pilot error. I simply forgot to remember the crossfeed, but I feel there is really much more under it all. If I were to investigate my mishap as an impartial ASO, I would have to criticize myself for not landing at the first sign of a fuel discrepancy. All the indications were there, and yet, other cause factors were present and unfortunately more dominant; they prevented my earlier landing. I believe these underlying causes are far more basic than fuel crossfeeding, if that's possible, and thus effect all pilots. They are:

1. *Failure to correctly interpret and analyze available instrumentation.* I first doubted and then completely distrusted the accuracy of my fuel gages.

2. *Failure to terminate a flight short of completion for precautionary reasons.* With a known or suspected fuel discrepancy, I should have just come home and landed. The urge to complete was so strong that it swayed me into first making, and then accepting an unsafe decision. I know that many accidents may be caused by a pilot letting down his professional guard to the constant pressing "tempo of operations."

3. Perhaps this last cause is least important, but I feel it is worthy of mention anyway. *Failure to react to my own apprehensive feelings as an unsafe situation developed.* I really felt uneasy and wanted to land, but did nothing.

As I said earlier, "It can't happen to me!" but it did. I know my errors look and sound anything but professional, but as the saying goes, "It seemed like a good idea at the time." Looking back, I am sorry it happened, but I feel I learned a valuable and inexpensive lesson from it all. In most cases, "Hind sight is poor sight," but not so in safety. It's good economics to profit from somebody else's mistakes before they cause an accident, maybe yours. So, report all incidents as they happen and remember; we are all vulnerable.

Reader Questions & Headmouse Answers

Have you a question? Send it to Headmouse, U. S. Naval Aviation Safety Center, Norfolk, Virginia 23511. He'll do his best to get you and other readers the answer.

Auto-Pilot Antics

Dear Headmouse:

We (pilot, NFO and crew of three) were winging along on the last leg homeward in an A-1E. We had been airborne over six hours and happy that another hour would see us home. Cruising along at 6500', I punched "Iron George" and leaned back into complacency. The crew and I had unlocked our harnesses and loosened our lap belts. I (the pilot) removed my helmet and held it in my left hand while I wiped my face and neck.

BANG! The aircraft went into a violent nose-down attitude at such an angle that the horizon could not be seen. Everyone hit the overhead. Having my helmet off did not help matters because I was dazed to the point that my vision was blurred. The 1.5 negative G persisted, holding the NFO and me to the top of our canopy. The NFO was trying desperately to reach the Auto Pilot Engaging Knob and I went for the Emergency Auto Pilot Release T Handle. On my second swipe I was able to grab the T and disengage "Iron George."

The negative G quit and I was returned to my seat. Then I was able to grab the controls and pull us out of an almost vertical attitude. Because we were indicating 270 kts at about 1500' above the ground, I felt a hard pull-out was imperative. Three and one half G got us safely back to level flight. While climbing back to 6500', I was able to regain enough composure to check on the others. One man in the aft section, whose seat faced aft had broken through the rear enclosure with his APH-5. He only sustained bruises while the other crewmen seemed unhurt.

The controls felt a little stiff so I had one of the men check the aft hell-hole. The investigation revealed that a spare Mk-2 life vest had caught in the control cables. When removed, everything functioned normally again.

Five minutes short of home, I noticed a slow increase in the fuel quantity gage and alerted the crew for another possible emergency. I thought the fuel vents might have become clogged somehow in our recent violent maneuver and I worried about fuel starvation. The gage went by the 2200 mark and around to zero again picking up speed all the while. Fortunately, the fuel pressure remained constant. The tower operator cleared us for a straight-in approach and we landed without further incident.

When the attitude gyro was removed for inspection, one small screw was found adrift therein. This was suspected as the culprit. A cargo net has since been constructed to hold gear in the hell-hole to prevent fouling the control cables.

There are six releases for the auto-pilot: (1) battery switch; (2) engaging knob; (3) switch from Number 2 inverter to Number 1 inverter; (4) cage the directional gyro; (5) switch from internal power to external power on the AC selector switch and (6) the emergency release T handle which mechanically disengages the Auto-Pilot in three places. Any comments?

SHY AUTO-PILOT MOUSE

▶ When airborne, you must be prepared every second for the unexpected. Hitting a sudden bit of rough air has caused similar incidents. A constant effort is underway to make air crews more comfortable so they will not be tempted to remove or loosen belts as well as flight gear, particularly when in the driver's seat.

Very resp'y,

Headmouse

GCA Confusion

Dear Headmouse:

I was 3 miles out on GCA final in moderate rain when the GCA operator relayed a tower instructed waveoff. I was given a 350 degrees heading while climbing to 3500'. When about 8 miles north of the field and holding at 3500', I was vectored on a heading of 090 degrees and told to remain at the same altitude. A few moments later I received a transmission to turn further right to 170 degrees and to descend to 2000'. Upon acknowledging the message, I commenced descending. Fortunately, I knew the local terrain layout and suddenly realized I would soon be sharing the space with a mountain called Monkey—an object with solid priority rights. Already being below 3000',

my pulse pounded noticeably until I was safely back to 3500'. Then I contacted GCA and re-read my clearance which I should have done in the first place. My blood pressure did not subside when the GCA operator said. "Negative that clearance, it was for another aircraft." Any comments?

MOUNTAINLESS MOUSE

▶ Yes, under actual IFR conditions, communications are important—and accuracy paramount. That is why the NATOPS Instrument Flight Manual (pub. by CNO on 21 Sept. 1966) says instructions should be read back if there is any confusion or possibility of a mistake. Moreover, call-signs should be checked and double-checked.

Very resp'y,

Headmouse

NTS Check

Dear Headmouse:

After a P-3A arrived on station for a night ASW event, the pilot asked the flight engineer to perform an NTS (negative torque system) check on the No. 1 engine. This was just prior to a planned shutdown of that engine in order to assume the three-engine loiter configuration.

The flight engineer was at that time in the after station so the second mech was sitting in for him. Assuming that the order was understood, the pilot reduced power on the selected engine. Immediately thereafter the second mech called, "Number one prop pump light," and feathered the engine immediately without allowing the pilot time to note the situation and determine the proper action.

Subsequent questioning of the second mech revealed that he assumed a prop malfunction when he noted a TIT drop on the gage at the flight engineer's station. When in actual fact, the TIT drop was caused by the pilot when he purposely retarded the power lever to begin the NTS check. Under the circumstances, the second mech thought he was doing the right thing. Confusion reigned for a few minutes, because the pilot thought the engine had flamed out. After a normal restart, everything checked satisfactorily.

Your opinions would be appreciated.

FOUR-ENGINED MOUSE

▶ Several mistakes are noted here. (1) The pilot ordered the NTS check without realizing that the second mech was not completely indoctrinated. (2) Under such conditions the flight engineer should have been monitoring the second mech. (3) An unqualified crewmember was allowed to assume the pilot's responsibility in the case of a suspected malfunction. All are NATOPS violations. Let's hope corrective instructions have been issued.

Very resp'y,

Headmouse

Unlike the flight control systems on present day high performance aircraft—the Naval Aviation Safety Center desires a continued feedback.

Has information in any Safety Center publication ever helped you to prevent an accident, avert an injury, or deal with an emergency in a better way?

If so, and you have not already informed the Safety Center, it is particularly desired and important that you do so. Such feedback is vital to all departments at the Center and for fiscal support of our safety research and education program.

Instrument Check

Dear Headmouse:

Upon swinging onto the runway for takeoff, the pilot opened the A-1's throttle all the way. A quick check of the engine instruments revealed something short of full power. The alert pilot aborted the takeoff, returned to the line and downed the aircraft.

A full throttle check on the line by the maintenance crew confirmed the pilot's findings. A thorough inspection revealed that the cover from one of the port console emergency flood lights had fallen into the throttle quadrant thereby preventing the throttle from reaching the stop.

It had been noted on at least two previous flights that the cover in question was missing. Chances are that with each flight, the cover inched further down into the wedge of the quadrant and finally traveled far enough to jam the throttle short of the full forward position.

It is now squadron policy to down an airplane when an item is possibly missing within the machine until a thorough search is made. Do you concur?

POWER REDUCED MOUSE

▶ The history of airplanes is replete with Irish Pennants adrift within the machines. For every one discovered before it causes an accident, there must be at least as many which have caused very tense moments and even actual crashes. When in doubt—stop—and check.

Very resp'y,

Headmouse

Status of Life Vests, Mk-I

Dear Headmouse:

In the September 1965 issue, in answer to a letter in regard to flotation gear for flight deck personnel, you said that more information would be forthcoming. I was wondering what, if any, decisions have been made and when these decisions will be incorporated for fleet use.

I feel that the pace and dangers inherent with modern jet carriers demand that some protection be provided for flight deck personnel in the event of being blown over the side.

ANTHONY W. CARLTON
AVIATION EQUIPMENT OFFICER, VA-83

▶ Please see page 36 for developments of the Mk-I, vest type life preserver.

Naval Ship Engineering Center message 042024 Oct 66 to Ships Parts Control Center stated: "CNO advises most urgent procurement flight deck preservers be expedited. 2H funds now available. Advise alcon procurement status and expected delivery date. For Fleet Commanders advise SPCC soonest destination, quantity, color and size. Colors: yellow, blue, red, green, brown, purple and white. Sizes: small, medium and large."

Very resp'y,

Headmouse

THE SECRETARY OF THE NAVY
WASHINGTON

The Secretary of the Navy takes pleasure in presenting the NAVY COMMENDATION MEDAL to

CAPTAIN WILLIAM A. KIERNAN
UNITED STATES NAVY

for service as set forth in the following

CITATION:

For meritorious service from 13 July 1964 to 11 July 1966 as the Force Safety Officer on the staff of Commander Naval Air Force, U. S. Atlantic Fleet. During this period, Captain Kiernan was individually responsible for promoting safety throughout the Naval Air Force, U. S. Atlantic Fleet. Through personal study and briefings therefrom, he dynamically stimulated action by aviation personnel to identify problem areas and initiate prompt corrective measures to eliminate hazards, resulting in a thirty percent reduction in the aircraft accident rate and a corresponding decrease in the carrier landing rate, fatal accident rate and fatalities during his tenure. This unprecedented reduction in accident rates produced untold savings in lives and valuable equipment. In addition, Captain Kiernan pursued the development, evaluation and procurement of the present life jacket undergoing manufacture, and it is anticipated that out of this originally limited-use item will come fleet-wide application. He was singularly responsible for the development of a managerial tool whereby units competing for the annual Chief of Naval Operations aviation safety awards are measured in relation to how well they were expected to do as opposed to how well they actually did. Captain Kiernan's outstanding leadership, professional competence and devotion to duty were in keeping with the highest traditions of the United States Naval Service.

Paul H. Nitze
Secretary of the Navy

A SAFETY FIRST

For his singular achievements in promoting the naval aviation safety program, the Secretary of the Navy recently awarded the Navy Commendation Medal to Captain William A. Kiernan, USN.

The award was made in recognition of Captain Kiernan's tireless efforts in directing a program that produced, throughout the Atlantic Fleet, unprecedented savings in lives and material resources. The award also reflects credit on everyone who actively supported the aviation safety program during this period, and it should serve them as the basis for a great amount of personal satisfaction.

Habit Pattern Interference in Flight

Recent correspondence received at the Safety Center indicates that some pilots believe that the naval aviation safety program advocates use of the checklist as the categorical answer to habit pattern interference mishaps. The checklist alone is definitely not an all-purpose remedy. It is, however, a valuable adjunct to alert, conscious and efficient operation of aircraft. It is hoped that the following article, based on pertinent accidents and incidents occuring in Fiscal Years 1965 and 1966, will shed some light on the subject. . .

On a high altitude air-to-air gunnery hop an experienced section leader led a flight in which two pilots had not previously flown in the air-to-air gunnery pattern. After six to eight dummy runs, the lead aircraft flamed out from fuel exhaustion on the second firing pass and the pilot ejected at 5400'.

Engine and fuel transfer system malfunctions were ruled out. The cause of the accident was attributed to pilot error. The distraction of supervising two relatively inexperienced pilots in the gunnery pattern and concentrating on target tracking was sufficient to interrupt the leader's habit pattern.

This did not eliminate the pilot's responsibility to check remaining fuel but it might help explain why he did not do so.

Sequences of Learned Actions

This mishap is typical of situations which can occur when those sequences of learned actions which we loosely term "habit patterns" are interrupted. When a particular stimulus to our attention is strong enough to override other stimuli, we concentrate on the one thing to the exclusion and neglect of others. The more routine a series of actions has become, the easier it seems to be for the nonroutine to break the habit pattern.

The F-8 board's discussion is pertinent here:

"The board is of the opinion, and this is supported by the medical member, that routine procedures tend to become habitual. This means that they are nearly conditioned responses and require little conscious effort on the part of the individual. And the more experience a pilot has, the stronger the habit patterns become. Acts that require a high degree of attention for the inexperienced pilot no longer do for the experienced aviator.

"When distractions interrupt the routine of flying, the habit patterns are broken. Activities which habitually are undertaken at a particular time are overlooked when extraneous activity is introduced. The result is that certain acts are omitted—sometimes with disastrous results. This the board believes occured in this case."

Similar Mishaps

The next two mishaps involve SH-3As. In very similar circumstances, both pilots experienced habit pattern interference and both failed to use the checklist.

On a utility transfer, an SH-3A pilot briefed for a hover transfer in which the crewman was to utilize the personnel hoist when over the ship. While in a hover over the landing area, however, the pilot was directed to land. The aircraft touched down, with the gear retracted.

Continued page 28

as requir
7. Altimeter — Set.
8. PITOT ANTI-ICE, ENGINE ANTI-ICE
ANDING CHECK LIST
2. Gear — DOWN.
3. Hook — as required.
4. APC — Engage and check.
102

"The approach area was restricted by reason of an UNREP in progress with one cruiser and one destroyer along either side," the report indicates. "The wind was on the bow, creating a disturbed air condition in the landing area. These conditions, coupled with last-minute directions to land, distracted the pilot's attention from normal procedures."

The squadron commanding officer was of the opinion that the incident could have been prevented by use of the landing checklist.

"The pilot's habit pattern was disrupted when he departed his safe hover condition and mechanically followed the director's flag signal to land on the flight deck area," the commanding officer wrote. (It is now the squadron's doctrine that the landing checklist be completed, including lowering of the landing gear, on all helicopter transfers regardless of type ship and whether or not a landing is contemplated.)

Outside Distractions

In a second SH-3A incident—this one, a personnel transfer flight—confusion on deck and a restricted landing area distracted the pilot's attention.

He intended to use the personnel hoist when over the ship but was requested to land. He landed with gear retracted. At the time, the pilot had 1234 total flight hours, 1010 total helicopter hours and 697 in model. "This mishap could have been prevented had the pilot performed his first intention of utilizing the personnel hoist on this mission," the board observed. "The habit pattern was broken and a landing was decided upon while in the hover. The landing was made without utilizing the landing checklist."

Multiple Qualifications

Habit pattern interference is a hazard to the pilot transitioning from one model of aircraft to another as well as to the pilot who must fly a number of different aircraft.

A case in point here is that of the T-28B pilot who used a nonstandard approach, starting high, close-in and carrying excess speed throughout. As the airspeed passed through 90 kts, he closed the speed brake. The nose of the aircraft fell through and touchdown was nosewheel first. He heard a scraping noise and initiated a go-around. All three prop tips were pitted and gouged beyond local repair limits.

"The pilot involved is a well-qualified, steady pilot and is, in fact, the T-28B NATOPS standardization evaluator for this activity," the report states. "It is worthwhile, therefore, to examine possible underlying cause factors. Overconfidence may have been a factor; however, with the personality involved, it is doubtful. A more probable contributing factor was . . . habit pattern.

"LT Doakes," the report continues, "flies the T-2A and the T-28B about equally in his duties. The use of speed brakes in the jet is routine and completely acceptable. It is, therefore, considered that the familiar habit pattern of T-2A flying overcame the knowledge that T-28B speed brakes produce nose-down trim on retraction and that they cannot, therefore, be used in the same manner as in the T-2A. This incident again emphasizes the need for constant vigilance, analysis, education and re-education in the knowledge and use of proper and standardized procedures. It further indicates the need for extra emphasis on alertness when multiple aircraft qualifications are involved."

T-28B Habit In TF-9J

A similar instance involved another pilot with considerable experience in the T-28B. On his syllabus solo in a TF-9J he noted he had inadvertently flown into an Area of Positive Control without clearance. Realizing his oversight and attempting to evacuate the APC hurriedly, he moved the throttle to the cut-off position causing the engine to flame out. He was unable to obtain an airstart in an estimated six tries and had to eject.

"That the pilot factor was the initiating cause of this accident is irrefutable," the board states. "Which pilot factor is quite another matter. Habit pattern is suspected because of the concentration of T-28B flights during the previous six months (average 97 hours per month) and the dissimilarity of the throttle function in the two aircraft. Pilot factor may also be a contributing cause factor because of failure to use and deviation from the NATOPS pilot's checklist." The report noted that every airstart attempt should have been done utilizing the NATOPS checklist. The final cause assigned by the Safety Center in this accident was pilot error (inadvertent flameout and improper relight procedures) as the primary factor and material failure/malfunction (emergency igniter cartridges) as a contributing factor.

Distractions

Sometimes distractions interrupt the normal use of the checklist with unhappy results. Take an S-2 pilot, for instance, who after transmitting "gear down and locked" made a gear-up landing on final touch-and-go.

The landing checklist in the S-2 is to be completed by challenge and reply prior to the aircraft's reaching the abeam or 180-degree position. Both pilot and the aircrewman stated this was the case on all previous touch-and-go landings. On the final touch-and-go, the landing checklist was not com-

pleted as the aircraft approached the abeam position because both pilots were concentrating on obtaining a correct landing interval between an S-2 ahead in the bounce pattern and a P-2E full stop from GCA.

Our S-2 pilot started the landing checklist as the aircraft entered downwind. He was interrupted by a tower transmission to follow the S-2 ahead. When he returned to the checklist, he inadvertently started after the item "landing gear" and did not recognize his oversight. (There was no wheels watch here to possibly save the day since single-piloted aircraft were not operating.) The board concluded that habit establishment developed through repeated and excessive landings without interruption led to the omission of standard procedures.

Experience No Guarantee

As evidenced in several of the above cases, long experience and many hours in model do not protect a pilot from habit pattern interference. For instance, there was a pilot with 2200 hours flight time including 1800 in the A-4. After a 2.8-hour instrument flight, he made a wheels-up night VFR landing in an A-4C. He had failed to lower his landing gear after raising it to check the lead aircraft for an unsafe gear indication. The incident report states that he "neglected to utilize two primary means of insuring the landing gear was down and locked: the landing checklist and the angle of attack indexer light. The landing gear handle and indicator should be the first items checked when the indexer light is observed to be out."

Internal Distractions, Fatigue

Thus far, most of the mishaps we have considered involve distractions from outside the cockpit. Distractions in the cockpit and even physical and mental distractions "inside" the pilot can cause habit pattern interference. Internal distractions include such things as toothache, sinus and ear blocks during descent, indigestion, hunger pangs and even thoughts of overdue bills or upcoming appointments.

Poor physical condition or fatigue can lower a pilot's level of performance which in turn can create habit pattern interference. Consider the following case which illustrates both the effects of cockpit confusion and fatigue on habit patterns.

A UC-45J was on a night proficiency flight. The pilot made three GCAs to touch-and-go landings and the copilot made three. The aircraft then departed the GCA pattern and entered the touch-and-go pattern. The pilot was making his first touch-and-go when he inadvertently raised the landing gear handle during the takeoff roll. The aircraft was at an estimated 80 to 85 kts when the gear retracted and the props on both engines nicked the runway for a distance of about 42'. The pilot rotated the aircraft and became airborne, went around and landed without further incident.

"The pilot stated that he knew he was tired but wanted to get a full 4 hours flight time," the report states. The fact that the pilot had thought about how tired he was and his subsequent actions are indicative that fatigue was a possible contributive factor.

"The pilot stated that the point on the takeoff roll where he raised the gear handle was at the same point where he had turned off the landing lights on the previous touch-and-gos," the report continues. "Interference of habit pattern due to some cockpit confusion is considered a contributing factor. The pilot's attention was focused on making the takeoff, adding takeoff power, telling the copilot to raise flaps and attempting to turn off the landing lights all in too short a time interval."

Established By Training

Habit patterns are established by training and long practice. Each time an action is repeated, the habit pattern is reinforced. (This is why it is so important to do each thing right each time.) Through overlearning, so to speak, our habit patterns become second nature to us. "Routine procedures tend to become habitual" as the F-8 board quoted earlier said. And vice versa, habitual procedures tend to become routine. Here lies the danger.

As how we do a thing becomes so well-learned that it becomes instinctive, habitual, routine, more than ever we need "when and where" direction from conscious thought. This is not always easy, but neither is it impossible. We can get assistance and reminders in directing our conscious thought by using checklists.

Summary

In summary, how can we best combat habit pattern interference?

- Vigilance and continual alertness as far as humanly possible, with an underlying awareness that no two flights or operations can be absolutely identical.
- Good physical condition and adequate rest.
- And last but certainly not least, the conscious, intelligent, consistent use of checklists.

The point we are trying to make is that the checklist has been, and continues to be, the pilot's only concrete insurance against omissions resulting from preoccupation, interruptions in a sequence of events, etc. . . Check? Check.

This is the combat survival story of a pilot whose F-8 was hit by ground fire while bombing a bridge. He turned out to sea, picked up a flight of F-8s and A-4s, and after control difficulties became insurmountable, finally managed to eject by means of the alternate firing handle. After trouble inflating his life vest and shedding his parachute, he climbed aboard his partially inflated life raft. As the flight ahead held off the approaching junks and sampans, he was picked up by an Air Force Albatross.

Trouble Along the Way

"I reached for the face curtain and moved to snap the throttle out of burner as the nose passed through the horizon," he recalls. "The bird commenced an uncontrolled outside loop with increasing negative G. Using both hands, I pulled the face curtain with no success. I tried to straighten the aircraft with left rudder as it commenced a starboard roll but there was no control response to the rudder movement either. I pulled two more times on the face curtain with as much leverage as I could muster from an increasing negative G predicament with increasing nose-down attitude. The face curtain was pulled out about a foot, but the canopy did not blow and the surface of the water was getting close. I reached for the alternate firing handle with both hands and pulled once with no success.

"By this time the aircraft was in a steep nose-down attitude with 40 to 60 degrees of starboard bank and there was no horizon visible through the windscreen or canopy. The airspeed had increased to perhaps 400-450 kts and I was rapidly running out of altitude. I thought 'If the seat goes this time it's going to be close' and I put all my remaining energy into the alternate firing handle.

"I went into the airstream with a healthy snap and the chute opened immediately. I heard the aircraft hit the water perhaps 3 or 4 seconds after the chute opened and I started through my overwater descent procedures. I took off my oxygen mask and reached down to unplug the hose from the seat pan but it was already torn loose.

"My helmet visor which had been down before ejection was completely gone and there was a deep gash on my right hand which was bleeding quite heavily. I released the port seat pan rocket fastener, pulled it up with my right hand and pulled out the yellow lanyard and snap which I attached to a ring on the front of my Mk-3C. The Mk-3C and other gear had been twisted out of position by the wind blast so that I could not find the toggles and there was little altitude remaining in which to complete the descent procedures.

"As I reached up the risers to locate the rocket fasteners, the water 'approached' rapidly. I went in easily and submerged completely. There was little wind and the risers and the edge of the chute collapsed on top of me. I started to sink without surfacing and held my breath while searching under the Mk-3C and cords in front of me for the toggles to the life preserver. They weren't where I knew they should have been and as I ran out of air, I had to fight my way back to the surface.

"Twice more I took in a deep breath with some salt water from the choppy seas that broke over my helmet and I allowed myself to sink as I searched the bottom of the life vest on both sides for the toggles. I did not try to fight the shroudlines which were beginning to entangle me with the rest of the gear though I did try to utilize the seat pack, which was barely floating, to keep myself above water. It started to sink with me.

"On about the third submersion I located the starboard toggle which had been pulled up inside of the life vest or into some of the other gear and pulled it with no results. The chute was starting to sink and I continued to have to fight my way to the surface for an occasional breath of air. I tried to release the rocket fittings from the sinking chute before continuing to work with the Mk-3C. The port rocket fastener released quite easily but I could not find the starboard one in the tangle of webbing and shroudlines. Green dye marker had been torn loose

some time just before or just after contact with the water. The area had turned to a highly visible emerald color.

"It occurred to me that very soon the increasing density of the canopy, shrouds and gear weighing me down would prevent me from being able to return to the surface at all and that I could no longer hold enough air to prevent onset of the initial stages of drowning. There was still no terror involved, only an abstract consciousness of what was occurring and what remained to be done in order to survive. On perhaps the seventh or eighth submersion I located the port toggle which had also been twisted behind some straps or harnesses. The life jacket partially inflated with a single tug. It was enough to keep my head above the surface although the waves kept breaking over me. I leaned back in the vest and relaxed long enough to get a few good breaths of air. Shroud lines had entangled everything, although surprisingly not too tightly. I ignored them and made no attempt to struggle free.

"Some time during the first moments in the water I had released the starboard pan rocket fastener. I pulled the seat pan to me and attempted to pull out the lanyard but it was fouled by cord on the inside and would not come free. I turned the pan over and located the metal ring which releases the clip holding the pan together. The pan opened easily and I pulled out the life raft and inflated it. It did not completely inflate but I turned it around with the small end towards me. I pulled it down and underneath me and at the same time rolled into the end of it without much difficulty. Shroud lines, straps and most of the accessories came into the raft with me.

"During the descent I had noticed that I was going to land in the midst of a number of junks and sampans and while I was in the water I became aware of jets and props making strafing runs on the nearest vessels approximately 100 yds from me. In the raft I had a good view of strafing and rocket runs by the aircraft overhead as the sampans continued to drift closer to me. Despite many direct hits the vessels continued to float and did not break up or settle in the water at all.

"I removed the shroud cutter and began cutting away the lines that still attached me to the canopy. It was a very effective tool and in a short time I had most of them cut away. I reached over my shoulder to locate the starboard rocket fastener and found it in a tangle of harness restraint straps and risers. I released the fastener but all that remained was 2 to 3′ of riser with no shroud line attached. I then reached under the end of the life raft with my foot to bring up the remaining shroud lines and completed cutting myself free from the canopy. The laceration on my hand continued to turn the water flowing through the life raft red and I began to feel a bit weak and a little sick. There was no pain associated with any specific injury or area but each movement seemed to require extra energy and conscious effort.

"The survival gear and accessories attached to me appeared to have been pulled apart and disordered upon ejection. I attemped to unzip the survival vest in order to remove the radio but the zipper had been pulled apart and would not operate. I then reached for my pistol as one of the junks drifted closer to my position. The leather strap for the holster had separated and the pistol had remained with me only due to a braided nylon lanyard that was attached to the butt and the leather strap. I placed the pistol on my lap and after some small difficulty removed my radio from the port side of the survival vest. It worked like a charm. The ADs could read me well although I had some difficulty understanding them and I commented that there was not much probability of any survivors remaining aboard the nearest sampans.

"My hard hat was still on. (I found out later that it was cracked.) The visor was gone, but I had no inclination to remove it. The toe of my left boot was ripped down to the sole on both sides at the edge of the steel plate. The right sleeve of my flight suit was almost gone and was tangled up in the remaining straps on the torso harness behind my back. Apparently it had wrapped around the starboard chute rocket fastener, preventing me from disconnecting it in the water. One of the snaps on the Mk-3C was broken off and the starboard side of it appeared damaged. The starboard leg of my anti-G suit was ripped open.

"The aircraft canopy remained afloat nearby during the entire time.

"Aircraft overhead continued to make runs on the vessels which did not try to open up on me. At about that time I saw an Air Force *Albatross* approaching at approximately 5 miles distance. He made one circling pass overhead while he dropped a smoke rocket and made an approach directly towards me from downwind. The HU-16 touched down not far from me in an area free of sampans and stopped within 20 to 30′ of my raft. A swimmer from the HU-16 came out to hand me a ring with a cord attached and we were shortly aboard and clear of the area.

"The recovery by the *Albatross* was accomplished in a thoroughly expeditious and professional manner."

Survival Radios

By 2d LT A.I. Kent, USMC,
1st MAW Flight Equipment Officer

SEVERAL months ago, the First Marine Aircraft Wing had a very limited number of survival radios. The helicopter groups had none at all. Today there are enough radios in each fixed-wing group for two per pilot/aircrewman. In the helo groups there is one per pilot/aircrewman or four per helicopter.

The survival radio is considered by many pilots to be the most important piece of survival gear next to the ejection seat and the parachute. On the other hand, some consider it to be an unnecessary item due to the fact that rescue in most areas of Southeast Asia is accomplished quickly by the "buddy" helo or the Jolly Green Giant who is always near the strike scenes.

There have been many instances in recent months which prove that the last statement is false such as:

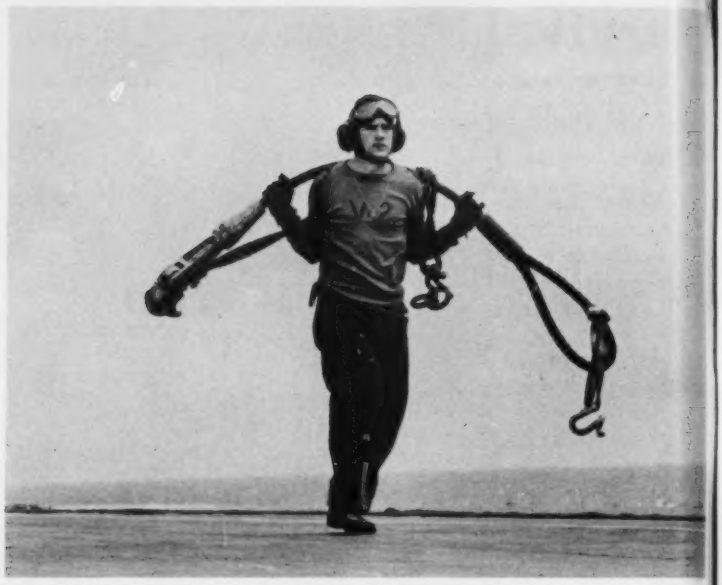
- The four helo crews who spent more than 24 hours in the jungle after their helos were shot down—without radios.
- The helo that flew into the water during a night med-evac—without radios. (The sole survivor was found about 10 hours later.)
- The helo that flew into a mountain—without radios. (It took the crew 3 hours to walk to a clearing where they were finally sighted.)
- And many others that have never been found.

The following quote is from a UH-1E pilot who has used the radio in two survival situations: "I have had two occasions to use the RT-10A survival radio. Both times the radio worked very satisfactorily. Both situations were during the hours of darkness. The first was on dry land and the radio was easily located in the survival kit. The second was in 4' of water. After locating the survival kit under water, I removed the radio. On both occasions I used my flashlight to read the instructions on the radio prior to using it and let the beeper run for about 15 seconds prior to trying voice communications. On the second occasion I had a little difficulty pulling the antenna out to ON. (My gloves were wet and one hand was injured.) I made about three pulls before I heard the radio activate. I made immediate voice communication on my first try both times. My transmissions were reported as coming in loud and clear by the circling aircraft. *I believe this is an outstanding piece of survival radio equipment and highly recommend that it be individually carried by each pilot.*"

A quote from the statement of another UH-1E pilot in a survival situation, "On the morning of——————at 0410 hours the helo which I was piloting crashed in a Vietnamese village. Immediately after the crash I attempted to use my personal survival radio (RT-10A), but had no success. It was tried intermittently for the next two hours, again without success. At 0630 the sound of helicopters was heard and I selected the beeper feature of the survival radio. Soon a helicopter came into sight and I spoke to him over the radio. A red smoke flare was popped and the helicopters had us in sight. We were rescued shortly thereafter. There is no question in my mind but that the survival radio was a major factor in our being located and subsequently rescued."

Although the RT-10A survival radio has been instrumental in saving lives in these three instances, there is one point that was evident in all of the situations: *How to operate the RT-10A survival radio was not fully understood.* This radio has four selections for use: (1) receive, (2) talk, (3) beeper and (4) beeper monitor. Don't wait until you actually need to know how to operate the radio. Get checked out on its operation *now*. See your local flight equipment or avionics personnel for a quick, thorough checkout.

—1st MAW Aviation Safety Bulletin



notes from your flight surgeon

Hearing Damage

SIX cases of nerve-loss deafness attributable to noise damage were diagnosed at sick call in a single cruise, a carrier's safety council reports. These persons will never have complete hearing again. The council proposes two solutions: 1) strict enforcement of regulations on wearing individual ear protectors and 2) insurance that supplies of Mickey Mouse noise suppressors are adequate." See Mickey Mouse Parts," page 46.

Sacrifices Protection

WHEN a T-28C crashed into a wooded area (power loss due to material failure), the rear seat occupant lost his hard hat on impact and received face injuries.

"Though strapped and locked in, he admittedly wore his hard hat with the chinstrap somewhat loose," the investigating flight surgeon reported. "As the aircraft came to an abrupt halt after impact, he was thrown violently forward. His hard hat rotated forward off his head and became wedged between his forehead and the edge of the glare shield at precisely the moment of maximum forward thrust of his head and torso. The lip mike hit his forehead, damaging the lip mike and cutting his face.

"The point of fixation of the hard hat is in the center of the chinstrap and with a whip-like motion of the head, the hard hat will tend to slide posteriorly along the under surface of the chin toward the neck. This, coupled with the tendency many pilots have to loosen the chinstrap for comfort, moves the center of fixation posteriorly and reduces the effectiveness of the nape strap, thereby allowing a relatively easy loss of the hard hat just when it may be most sorely needed.

"The most obvious solution would seem to be the use of a chinstrap or split chinstrap to help keep the center of fixation of the hard hat stationary. However,

many pilots with helo time have found this to be uncomfortable and somewhat restricting when a good deal of vocal interchange is necessary. This points up the necessity for continued study of the problem. *Meanwhile, all pilots must be urged to avoid the tendency to voluntarily reduce the effectiveness of their personal safety equipment for the sake of comfort.*"

Blowtorch

JUST before an F-4B became airborne on a normal afterburner field takeoff, there was a loud pop and hissing noise in the rear cockpit. An intense white-hot narrow flame like a blowtorch shot straight out 12 to 15 inches from the T-R test switch toward the RIO's right shoulder. The flame burned between 30 and 60 seconds before going out. The back of the right shoulder of the RIO's flight suit, his right parachute risers and the paint of the ejection seat frame were singed. Contact between loose a.c. and d.c. terminal wires in the switch causing a short and igniting the switch was suspected as the origin of the fire.

The fire retardant quality of the RIO's flight suit undoubtedly prevented ignition of the cloth and body burns.

Attention Required

AS an S-2E was taxied onto the starboard catapult the safety petty officer noticed the catapult shackle had a stripped pin. He proceeded from the vicinity of the shuttle to the starboard catwalk, then via the catwalk to a position aft of the aircraft engine to obtain a replacement pin. After getting the pin he proceeded at a rapid pace up to the flight deck and then forward along the aircraft starboard side between the deck edge and the aircraft starboard engine. When passing by the turning propeller, he bent over to avoid it. Upon returning to the front of the propeller and while replacing the pin, the catapult officer noticed the petty officer had been cut by the propeller.

The squadron report states that haste prompted the petty officer to disregard the safety of the catwalk and return to the shuttle via the flight deck. He was the second person struck by a propeller within a four-month period aboard the carrier who survived the experience.

"Both of the persons involved," the report concludes, "are living examples to all of us of the attention required when working near propellers or rotors."

Automatic Return

FAILURE of some component of the rudder system of a C-1A was thought to be the cause of a post-catapult shot accident. As the aircraft broke up on impact with the water, the cabin remained intact and sank rapidly.

"I saw the water come up and hit my side of the bubble canopy," the pilot recalls. "The initial jolt was slight; then there was a violent impact and the water rushed into the cockpit. I could not see because of the foam and bubbles. I felt myself being pitched forward and my helmet was gone. Some of the bubbles subsided and I tried to push out but with no success. Then my survival training in the Dunker came back and I started by releasing my lap belt. I swam out through a hole on the left side of the plane.

"Once free of the cockpit, I started to sink, probably because of my boots and the .45 I was wearing. I reached down and pulled the left toggle on my mae west; it inflated and I rose to the surface. I surfaced close to the tail of the aircraft which was still floating. The life rafts were already inflated and I grabbed on to the nearest one.

"I am convinced that my survival training contributed materially to saving my life. I had not recently reviewed survival procedures but once in the water, all the past training—particularly in the Dilbert Dunker—returned automatically."

Single Riser

ON parachute descent after ejection, a pilot noticed that the pull on his torso harness was unequal with more force on the left side. He looked up and saw, to his consternation, that his descent was being made on a single riser. The right shoulder rocket jet fitting was disconnected at the torso harness. This lucky pilot made a soft landing in a lake 300 yds from shore, had no trouble releasing his one connected fitting, and made his way to dry land.

Examination of the right fitting after its recovery failed to show any damage or malfunction. Investigators concluded that it had been improperly connected by the pilot in the first place and had separated at some time during the ejection sequence.

No Cuffs

AN A-1H pilot who had to exit his aircraft through flames was burned on his hands and wrists although he was wearing summer flying gloves. According to the accident report, he had one to two inches of the glove cuff cut off.

"This reduction in glove material and coverage," the squadron survival officer states, "undoubtedly added to the severity of the burns on the pilot's hands and wrists."

On the positive side, this pilot's eyes and head were protected from the flames by his helmet and visor. His visor was down during both the accident and his escape from the burning fuselage.

And now. . .

Ships Part Control Center, Mechanicsburg msg 021137 De 1966: "Deliveries of flight deck preservers estimated t commence 120-150 days from this date."

A Life Preserver for Flight Deck Use

By P. J. Rubilotta
Survival Systems Branch
U. S. Naval Applied Science Laboratory

A critical safety problem for flight deck crews aboard aircraft carriers has, until recently, been the lack of a simple, efficient emergency life preserver. These men are required to roll, slide on their backs, crawl on their stomachs, and perform other maneuvers peculiar to their duties which leave them unsecured so that they easily may be accidently blown over or fall off the side of a ship. High winds, unexpected jet blast, prop wash, and wet decks can result in the cry of "Man overboard."

While deck crewmen are servicing aircraft they must be unencumbered and therefore any life preserver that they wear must be uninflated and as compact as possible. Further, the uninflated preserver should, if possible be an integral part of the identification jackets worn by all crewmen during flight deck operations.

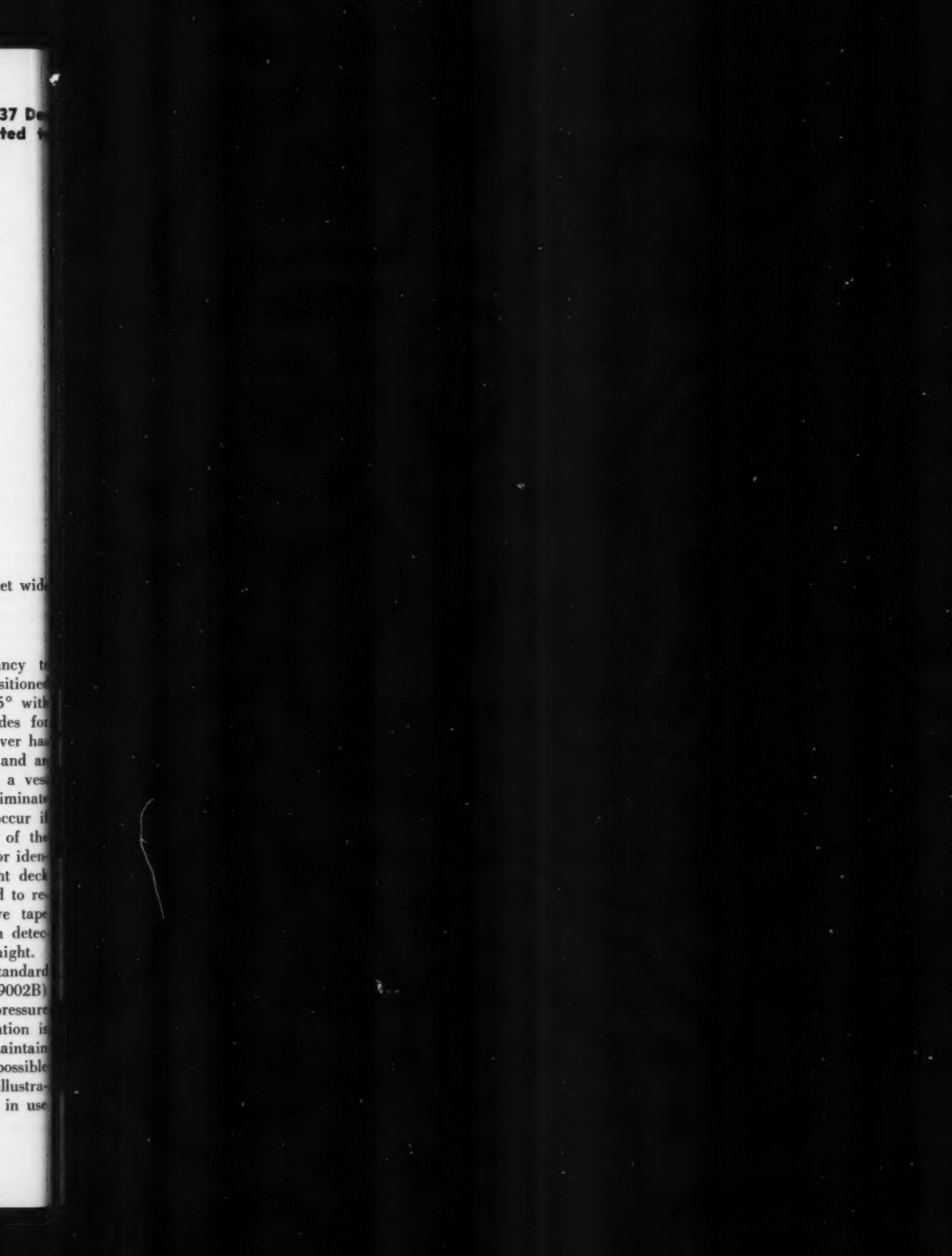
The Bureau of Ships called upon the Survival Systems Branch of the U.S. Naval Applied Science Laboratory to develop a life preserver that would fulfill this need. Drawing on their experience obtained in designing the Navy Mk-3 Yoke Type SCUBA Life Preserver and upon a prototype designed by the Naval Aviation Safety Center, a preserver was developed that in the spring of 1965 was widely distributed for fleet evaluation.

By midsummer 1965 reports from the fleet evaluation had been compiled. Acceptance was universal and plans and specifications have been prepared for quantity procurement of the preserver for fleet wid distribution.

Preserver Characteristics

The preserver provides sufficient buoyancy t float a man, and the flotation bladder is so positione that he will be maintained at an angle of 45° wit his head out of water. This feature provides fo the safety of an unconscious man. The preserver ha two main components, an outer fabric cover and a inner inflatable bladder. The outer cover is a ves made entirely of natural fibers, in order to eliminat the possibility of "melt" burns that might occur i synthetic fibers were used. The outer shell of th cover is dyed to match the color codes used for iden tification of the function of the various flight deck crewmen. The fabric is preshrunk and treated to re tard soiling and water absorption. Reflective tap has been applied to both shoulders to aid in detec tion and recovery of the man overboard at night.

The bladder of the preserver is made of standard life preserver material (Specification Mil-C-19002B) and can be inflated by CO_2 obtained from pressure cylinders. Provision for emergency oral inflation i also provided. A pressure relief valve, set to maintain a pressure differential of 1.5 psi, prevents possible rupture of the bladder by overinflation. The illustrations, right, show the vest type life preserver in use aboard RANDOLPH.



"I never go topside without it," says ABH3 F. W. Cadell, flight director aboard RANDOLPH, who has been in on the flight deck life preserver evaluation from the beginning. Here he demonstrates its merits while worn over a flight jacket.

Jet Engine Analyzer

NEEDED: A means by which an aircraft turbojet engine would say to the maintenance man at just the right time, loud and clear: "Take me out of the game, coach; I've got heat exhaustion." Absurd? Not really.

Now being introduced in Navy aircraft is a system which does just that, though it "speaks" a bit differently than suggested above. It's an automatic inflight jet engine analyzer, which monitors the deterioration of the engine's useful life as a result of accumulated damage to the hot section.

The analyzer system installations are being made in a *Crusader* squadron on both the east and west coast for testing.

The U. S. Air Force has procured more than 1000 of the systems for single-engine aircraft. Air Force use includes combat planes in Southeast Asia.

Purpose of the analyzer is to provide a more informed, scientific approach to engine utilization and maintenance—to achieve more efficient upkeep and safer flight.

It is proven that a jet engine deteriorates at a certain rate depending on operating time and temperature. The hotter you run the engine, the more rapidly metals incur damage in the hot section.

A typical engine, for example, *doubles* the rate of deterioration every 18°C. Thus, when an engine operates overtemp, it is being used up at an accelerated rate.

Heretofore, operational systems have not monitored, recorded and indicated an engine's time-temperature experience in a way that readily would give the maintenance man a reliable measurement of the engine's condition.

Pilot's reports of overtemp readings observed on cockpit gages are helpful clues, of course, but are spotty and provide no basis for a realistic estimate of engine condition.

Due to the lack of sure knowledge, provisions for engine removal and inspection have necessarily been generous—to provide a margin for safety.

That means many man-hours are expended to inspect engines that, it turns out, do not yet need any repair. Even so, sometimes an engine is flown with hot section damage that has accumulated quickly (but unknown) to the extent that flight is dangerous.

The inflight engine analyzer provides a go, or no-go gage that enables a mechanic to tell at a glance when an engine is safe to operate further without internal inspection, and when it must be pulled for examination.

What the mechanic glances at is a "hot section recorder"—a black box whose digital readouts feature the "hot section factor." This factor is automatically computed, cumulatively, from continuous measurements of engine running time and temperature.

Each hot section analyzer's computer is programmed for the engine to which it is applied, using data furnished by the engine manufacturer.

Along with the recorder and computer, the analyzer system includes an indicator-programmer which replaces the existing engine temperature indicator in the cockpit. The indicator-programmer provides the

Indicator Programmer

pilot with a digital indication of engine temperature, accurate to 2°C., plus a warning light that alerts the pilot to an overtemp condition.

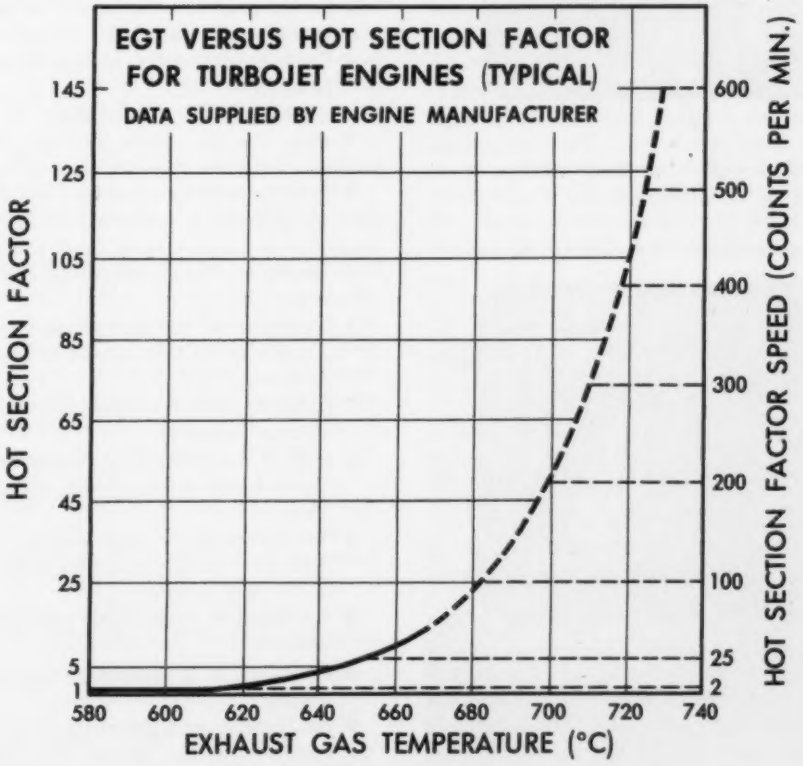
The indicator also supplies continuous signals of engine temperature to the hot section analyzer. The analyzer drives the hot section factor counter at a variable rate, depending on engine temperature, and the factor is presented as an accumulated number of units.

Engineers have prescribed that a certain engine can accumulate a hot section factor count of 20,000 units, let's say, before hot section damage is at the danger point. Knowing this, the mechanic checking the aircraft at any time has a basis for deciding whether the engine should be torn down for inspection of the hot section. If the counter shows only 8000 units since the hot section was new (or renewed), if nothing else calls for opening the engine, and if the mechanic reasonably can expect that the engine will not exceed 20,000 units before the next check, then he can intelligently defer inspection.

On the other hand, if the hot section factor is

Hot Section Factor Computer

HOT SECTION FACTOR VERSUS TEMPERATURE CURVE



When an engine operates overtemp it is being used up at an accelerated rate. . .

Spread Computer

Mechanics can tell at a glance whether an engine is go, or no-go.

Note temperature ranges of F-106, above; F-102, below.

near the allowed maximum, or if it is apparent that the count has accumulated especially fast per hour flown, then the mechanic has good reason to schedule a teardown and inspection of the engine, to head off a failure.

Extensive operational tests have shown the hot section factor to be a reliable indicator of hot section condition. Thus, it is a guide which enables maintenance personnel to keep powerplants in good condition with a minimum of man-hours and engine downtime.

Another feature which can be included in the analyzer system is an engine temperature spread computer. With this, the pilot can press a button and cause the temperature indicator to display the difference (spread) between the highest and lowest temperature readings of all the thermocouples in the EGT system.

Any time the spread is over the prescribed limit, the indicator flashes an excessive-spread light. Also, the indicator sends a signal which trips an over-spread flag on the face of the hot section recorder, to inform the mechanic subsequently checking the aircraft.

Service tests have shown that the analyzer system has helped corrective maintenance in various ways. Above-average gain in hot section factor count per flight hour has led to detection of these problems:

- Engine fuel controls out of adjustment;
- Defective fuel nozzles;
- Constant-speed-drive cooling doors out of adjustment;
- Afterburner nozzles sticking.

Without the hot section analyzer, many of these problems have gone undetected.

Beyond the obvious reduction in maintenance cost, through preventive maintenance, it is likely that catastrophic failures have been prevented.

In summary, here's what the in-flight analyzer system provides:

- Indication of the accumulated exposure to the engine's hot section, caused by excessive exhaust gas temperature.
- Exposure trend information for preventive maintenance purposes.
- Digital information of accumulated time the engine has been subjected to certain temperature levels.
- An indication to maintenance personnel and flight crew of the condition of the engine prior to the next mission.
- Assistance in eliminating premature hot section inspections.
- Assistance in programming engines to overhaul depots.
- An increase in flight safety by insuring prompt removal of the engine for overhaul when required.

—Courtesy Howell Instruments, Inc

NOTES and comments on maintenance

Vehicle Lights Around Aircraft Operating Lines

Over the years, accidents resulting from the effect of vehicle lights on the flight line have been a problem of continuing concern. During night operations vehicle lights being directed into the eyes of pilots results in temporary loss of night adaption and seeing an after-image. This condition blinds the pilots momentarily while attempting to control a moving aircraft.

One possible solution to the problem has involved shielding the lights on ASE vehicles and has been covered here before (July 63, p. 22, and Sept. 63, p. 22). Here's the approach taken by NAS Norfolk. Applications of these principles may be of value to you:

- Headlights on all vehicles, private and government shall be turned OFF and only parking lights used when headed toward a moving aircraft during night hours. If it is unsafe to proceed with parking lights, stop until aircraft have moved beyond headlight range.
- Low headlight beams only shall be used on vehicles or aviation support equipment operated in aircraft parking or operating areas during night hours.
- High headlight beam circuits on yellow and gray equipment or aviation support equipment that operate primarily around flight lines shall be disconnected. The dimmer switch circuit will be modified to prevent lights being switched to high beam.
- A suitable decal shall be located on the instrument panel adjacent to the light switch on affected vehicles indicating the high beam has been disconnected.

The high beam shall be reconnected and the dimmer switch reestablished on all vehicles prior to their use over highways beyond limits of the naval complex.

Arrangements for disconnection and reconnection of lights will be made through the Transportation Division.

Noise and Your Hearing

If you are wondering whether to wear ear plugs in a given situation, *wear them.* The minor inconvenience will not only preserve your hearing but allow you to work more safely. Noise has always been a problem in aviation. The jet engine has further complicated this hazard. Although flight crews are exposed to high noise levels it is the ground maintenance crew who run the highest risk. Possible consequences of noise exposure not only include damage to hearing but a variety of vague and often ill-defined complaints. Faulty maintenance work occurs and there is a potential rise in the incidence of accidents attributed to maintenance error. The ground accident rate is always high in a noisy environment.

Protection from noise is therefore an important item. Appreciation of noise hazard is required before corrective action can be taken. A sure indication that noise exposure has been too intense is awareness of decreased hearing or a hissing sound with or without ringing which in 24 hours will usually go away. There is now considerable evidence to indicate that, given equal overall intensity, noise of the jet will do more damage than will noise of the piston engine type. A single gun shot fired close to the ear can do as much damage as a thousand hours of jet noise exposure. The degree of hearing damage from noise also depends on the amount of time between exposures and

Would You Believe in This Day and Age? . . .
(Next Page Please)

the individual's inherent susceptibility to noise trauma.

The medical department at the time of each man's annual exam tests the hearing of all flight personnel, active duty or reserve. Flight line crews will receive a check twice a year. Ear plugs of proper fit are available on request. Noise levels above the intensity of 110 decibels will require the combination of ear plugs and ear muffs. The wearing of protective devices actually improves the ability to hear voices by reducing the masking effects of higher pitched noises. Feel free to consult your flight surgeon at any time regarding your hearing.

R. L. Anderson, LT MC
NARTU, NAF Andrews

Please see "Hearing Damage" page 34—Ed.

Tips on Fire Bottle Checks

IN RESPONSE to "Line Safety," Dec. 66 issue, Assistant Fire Chief R. C. Sommers of NavSta Gitmo makes the following points:

"The idea of having a designated PO make a daily inspection of flight line fire extinguishers is a good one. Since the Aircraft Firefighting and Rescue Manual, NavWeps 00-80R-14, and BuWeps Inst 11320.2A designate the responsibility for placement, maintenance, recharging and daily inspection of flight line fire extinguishers to the Fire Chief, flight line POs should be instructed to report any expended, damaged or missing extinguishers to the Fire Chief."

A note on checking 15-lb CO_2 extinguishers:

"In many cases these extinguishers receive rough treatment causing the syphon tube inside the extinguisher to break. Lifting and shaking the extinguisher may reveal a broken syphon tube (a rattling sound will be detected) requiring replacement of the extinguisher.

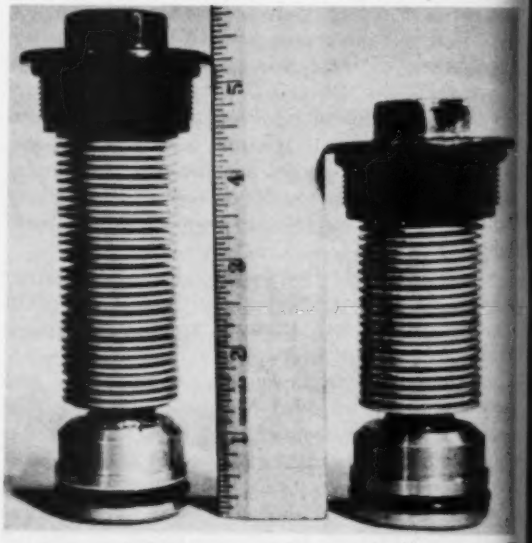
"Lifting the extinguisher, even though the seal is in place, may indicate by its light weight that the extinguisher has vented itself by way of the safety disc. This venting could be caused by excessive pressure inside the extinguisher due to a high ambient temperature or by exposure to jet engine blast."

Would You Believe? . . .

You Write the Caption.

Incorrect Oil Filter Installation—UH-2

The filter assembly, PN OT25995, on the main gearbox is 1-inch shorter in overall length than the oil pump filter, PN OW34270, on the speed decreaser gearbox. If this short filter is inadvertently installed



in the speed decreaser gearbox, a sizable gap will exist internally in the pump housing, contaminants can bypass the filter, and premature replacement of the speed decreaser gearbox assembly may result. The 1-inch difference between the two filters is not readily apparent unless they are placed side by side and, when installed, it is impossible to tell one filter from the other.

To prevent incorrect filter use, make sure the overall lengths correspond to those shown in the photo or check the part numbers. Comparing a new filter with the one removed from the speed decreaser gearbox oil pump is not a positive check since an incorrect installation may have been made previously.

—Kaman Rotor Tips

MURPHY'S LAW*

F-4 Murphy

CROSS-CONNECTION of the Remote Channel Indicator and the Missile Status Panel plugs in an F-4B during maintenance resulted in an inoperative RCI. Many man-hours were spent in troubleshooting this discrepancy.

It is uncertain what the effect would have been on the missile status because the aircraft had not been test-hopped.

Color-coding of the plugs and receptacles is recommended to preclude a recurrence of Murphy's Law in this instance. Better yet, a design change which would eliminate placement of identical plugs adjacent to each other is suggested.

—Contributed by ENS R. M. Fowler, FITRON 161

A-4 Ordnance Murphy

DURING a weapons exercise with an A-4B aircraft, its Mk-12, 20mm guns failed to fire when two cartridges jammed in the feeder throat. Cause of the trouble was traced to transposed pneumatic regulators and 1200 psi air being directed to the guncharger and rear buffer.

The effect of this arrangement slowed breechblock return and a speedup of ammunition through the feed mechanism causing a double feed. With 1200 psi air on the feed mechanism, cartridges were fed into the feeder throat faster than the slow moving 550 psi-fed breechblock could clear the first cartridge. This condition caused cartridge jamming and a blown T-seal which in turn caused a complete loss of air pressure in the pneumatic system.

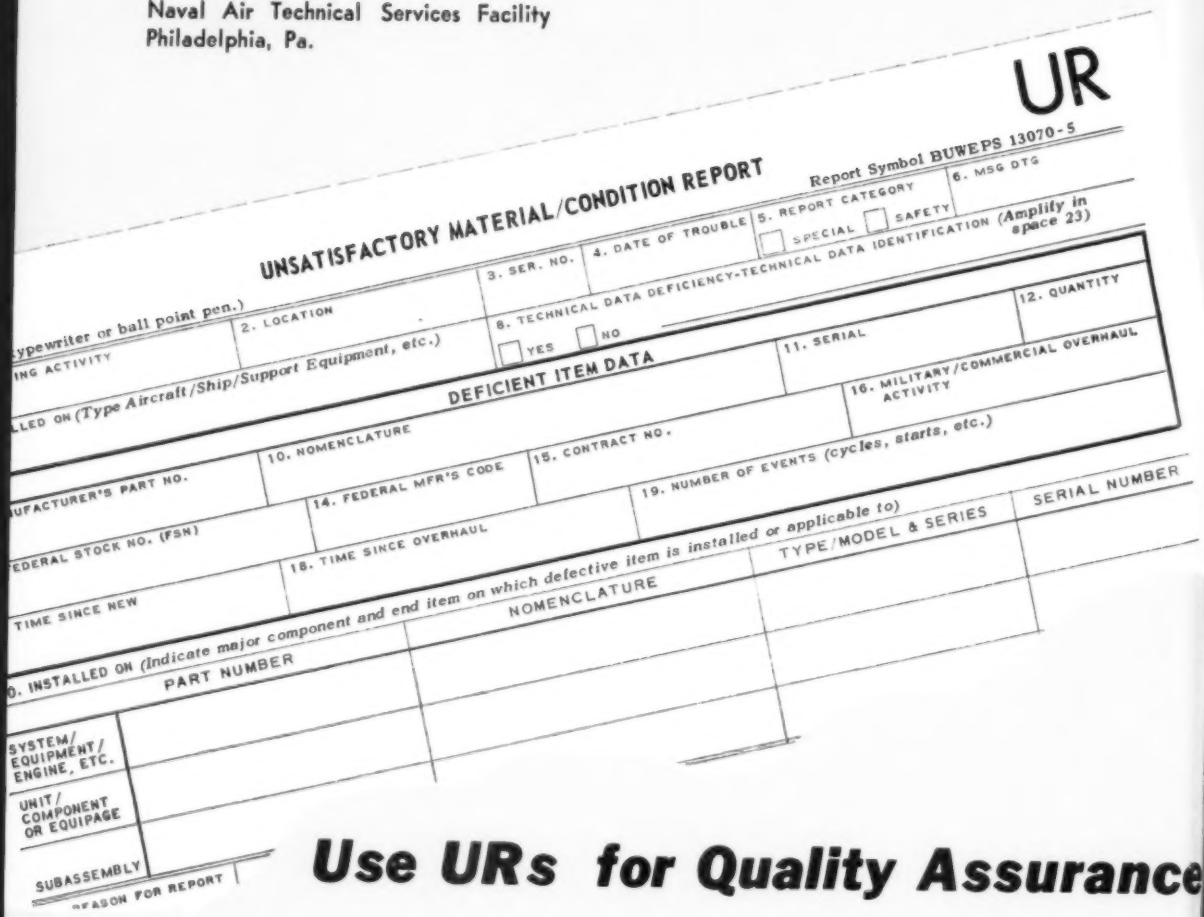
Both regulators are identical in appearance. To prevent a recurrence of this Murphy, a standard system of color coding is recommended to identify the regulators.

—Contributed by AO3 H. B. Caldwell, VSF-1

Although this Murphy could have been discovered before flight through part number identification (1200 psi reg. bears PN 178 1500 1200 and the 550 psi, PN 178 0800 550), or through a functional check with dummy cartridges, the design lends itself to easy misinstallation. A readier means of identification merits serious consideration. Accordingly, the NavSysCom cog has been so advised.—Ed.

*** If an aircraft part can be installed incorrectly, someone will install it that way!**

By W. A. Rubin
Naval Air Technical Services Facility
Philadelphia, Pa.



UR

UNSATISFACTORY MATERIAL/CONDITION REPORT

Report Symbol BUWEPS 13070-5

typewriter or ball point pen.)

ING ACTIVITY | 2. LOCATION | 3. SER. NO. | 4. DATE OF TROUBLE | 5. REPORT CATEGORY ☐ SPECIAL ☐ SAFETY | 6. MSG DTG

LLED ON (Type Aircraft/Ship/Support Equipment, etc.) | 8. TECHNICAL DATA DEFICIENCY-TECHNICAL DATA IDENTIFICATION (Amplify in space 23) ☐ YES ☐ NO

DEFICIENT ITEM DATA

UFACTURER'S PART NO. | 10. NOMENCLATURE | 11. SERIAL | 12. QUANTITY

EDERAL STOCK NO. (FSN) | 14. FEDERAL MFR'S CODE | 15. CONTRACT NO. | 16. MILITARY/COMMERCIAL OVERHAUL ACTIVITY

TIME SINCE NEW | 18. TIME SINCE OVERHAUL | 19. NUMBER OF EVENTS (cycles, starts, etc.)

0. INSTALLED ON (Indicate major component and end item on which defective item is installed or applicable to)

	PART NUMBER	NOMENCLATURE	TYPE/MODEL & SERIES	SERIAL NUMBER
SYSTEM/EQUIPMENT/ENGINE, ETC.				
UNIT/COMPONENT OR EQUIPAGE				
SUBASSEMBLY				

EASON FOR REPORT

Use URs for Quality Assurance

3M procedures today are the main line of reporting of unsatisfactory material conditions. But, for special circumstances, the UR method is used to expedite correction of item involving safety; faulty design (Murphy's Law), manufacture, rework, preservation, packaging errors and omissions in tech pubs. Here's how the URs work.

The Navy's Aeronautical Unsatisfactory Material/Condition Report (UR) (NavAir Form 13070/5) is recognized as a most effective tool for the reporting of discrepant material from using activities. The Naval Air Technical Services Facility (NATSF) is responsible for the collection, processing, analysis and distribution of feedback information derived from the URs, thus enabling Government inspection activities and contractors responsible for providing corrective action on material discrepancies and operational maintenance problems to carry out these responsibilities more effectively.

One of the many benefits of the UR, possibly not recognized by some reporting activities, is in the area of Quality Discrepancies which are attributable to faulty manufacturing/inspection or faulty preservation/packaging procedures as well as faulty commercial overhaul. To this end, NATSF has developed a program whereby facsimiles of URs reflecting the aforementioned discrepancies are sent to the cognizant Government contract administration office within 24 hours of receipt i.e., Defense Contract Administration Services Regions, Districts or Offices, Air Force Plant Representative Offices (AFPROs) or Naval Plant Representative Offices (NavPlantRepOs) for an appropriate investigation and corrective action. These reports involve material procured from a contractor under the cognizance of these offices.

The reports are reviewed and, as a minimum, discussed with the contractor to initiate appropriate corrective action and then filed in such a manner as to contribute to product and contractor quality history. When the UR reflects conditions which are significant departures from compliance or performance with contract requirements, an investigation and report are made. Particular and timely attention is required on reports involving material where a warranty or guarantee is in effect or latent defects may be involved.

In such instances, reports of investigation include facts which the Naval Air Systems Command (AIR-5042B) can use to assist in the recovery of costs and/or repair or replacement of the material at no cost to the Government. Contracting officers are kept informed in order that official contracting officer's action may be taken when required. These reports provide investigative feedback information to the Naval Air Systems Command (AIR-5042B) with copies to the U. S. Naval Weapons Quality Assurance Office (QAO-44), NATSF, the Reporting Activity and the Contracting Officer. NavAirSysCom (AIR-5042B), upon receipt of the report of investigation, makes additional distribution within the Naval Air Systems Command as appropriate.

It is important that accurate and concise information be furnished on the UR. Particularly, in order for the Government to recover costs and/or replacement of material, the contract number or any other identifying data relevant to the procurement of the deficient item should be shown on the UR. Providing this information insures a prompt investigation on the part of the investigating agency and avoids unnecessary administrative delays and workload while obtaining this information from the reporting activity.

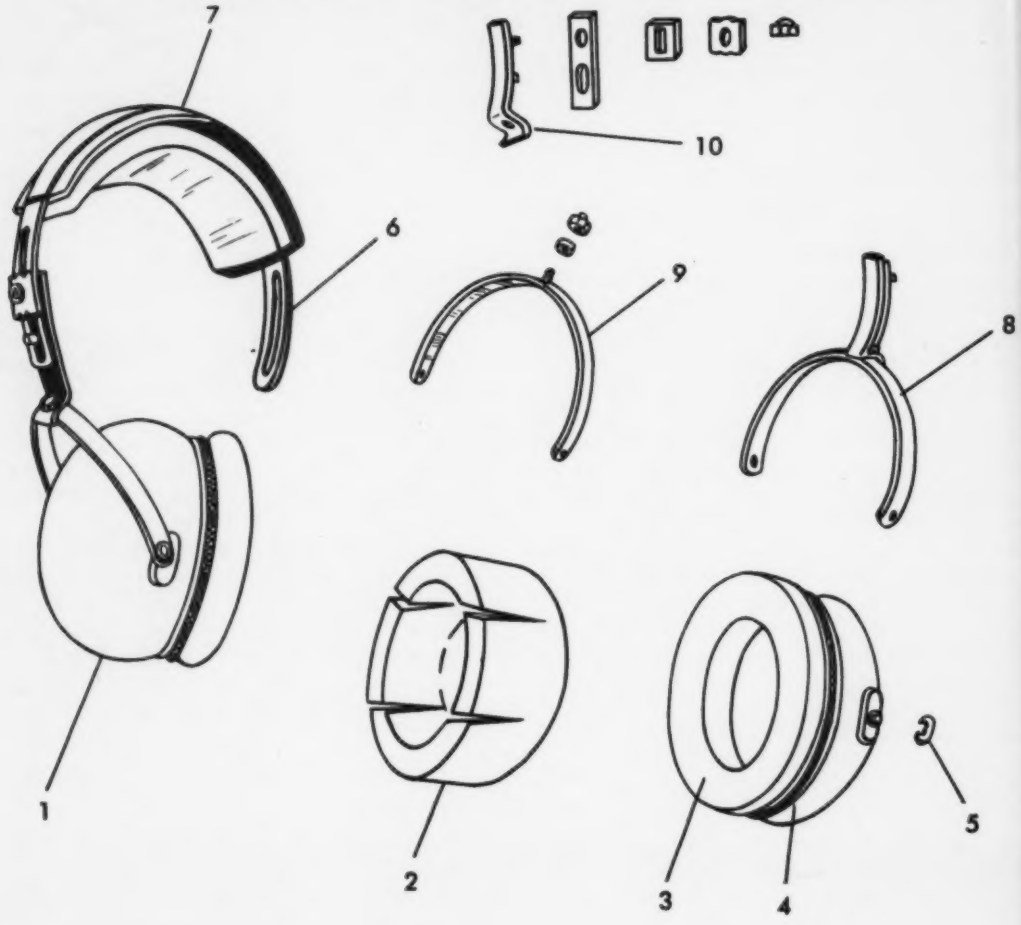
An example of recovery costs reflecting the effectiveness of the Quality Assurance Program, and resulting cost effectiveness, was depicted in a recent report received from a naval air station for the calendar year 1966. The report contained the following:

a. Value of defective items	$853,321.40
b. Inspection man-hours utilized	3791
c. Inspection man-hour money value	$ 30,707.10
d. 70% recovery through warranty replacement or repair	$597,324.98
e. Net savings as a result of timely UR reporting and activity centralized data collection	$566,617.88

From the above, the appreciable net savings achieved as a result of timely UR reporting of defective new material can be recognized. Not only is the Government benefiting monetarily, but the contractors are placed on the alert with respect to their quality control and inspection procedures.

So—let's have all the facts on the UR and NATSF will start the ball rolling.

MICKEY MOUSE PARTS



NOW "hear" this! Parts are available to repair defective sound attenuators (Mickey Mouse) ear muffs. Don't jeopardize your hearing by wearing bad sets or not wearing them at all. Simply order the parts you need.

Here are the stock numbers of replacement parts, items 2 and 3 for David Clark Co. ear protector models 19A and 372-9AN/2, FSN RD 4240-856-6650-LF-50:

2. Filter Puff, RM 4240-674-5379-LF-50, PN SP 1660C

3. Seal, Plastic RM 4240-979-4040-LF-50, PN SP 2014

Other parts shown can be ordered by manufacturer's part number as listed:

1. ASP-184, Dome Assembly
4. SP-2061, Dome
5. SP-3B, Retaining Ring
6. ASP-137, Headband Assembly
7. ASP-160, Headpad Assembly
8. ASP-80, Stirrup Assembly
9. SP-6, Stirrup
10. SP-234, Stirrup Clamp
11. SP-1645, Headband

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Address: APPROACH Editor, U. S. Naval Aviation Safety Center, NAS Norfolk, Va. 23511. Views expressed are those of the writers and do not imply endorsement by the U. S. Naval Aviation Safety Center.

Compound Error

FPO San Francisco—In reference to the A-4 nose cup bearing problem, July and November issues, it has been my recommendation to reject any wheel assembly on which the cup bearing is loose.

The cup bearing acts as the outer race for the wheel bearing, providing a hard polished surface for the wheel bearing to ride in. The cup bearing is installed in the wheel half by shrink fitting, marrying the wheel half to the steel cup bearing. The cup bearing should never be separated from the wheel, therefore never allowing this type of maintenance error to occur.

The installation as it is pictured is an error, but the acceptance of that wheel for installation is a more serious error.

AMCS GORDON B. PIERCE
RVAH-13

• According to NavWeps 01-40 AVC-2-2.2, Section 3, para. 3-204 you are absolutely correct. It states: "The entire wheel is no longer serviceable when the rim is cracked or distorted, or the bearing cups are loose and damaged. Turn into Supply for screening or shipment to a higher level maintenance facility." A compound error committed by the mechanics involved was also inadvertently overlooked by all concerned. Your keen observations are appreciated. May we all profit.

Mae West Collar

FPO San Francisco—The collar of the mae west rubbing the naval aviator's neck has been a problem since the inception of the vest. Foam rubber and other innovations have been used on the collar in attempts to alleviate this source of irritation. However, the problem has never been solved.

We in VS-21 believe we have the answer. Velcro sewn on the mae west straps and flight suit (as shown in the photo) and pressed together will hold the vest in a comfortable position while the wearer is flying. Inflation of the vest in the water pulls the velcro loose and allows the vest to support the pilot normally.

LT H. N. WRIGHT
ASO, VS-21

• We checked your idea out informally with the Aerospace Crew Equipment Laboratory (ACEL) and they have approved it as an interim measure until the new Mk-6 life preserver is available. The Mk-6 should eliminate discomfort in the collar areas.

Velcro sewn on flight suit and mae west straps as shown helps hold vest in position.

Mickey Mouse Parts Nos.

Santa Ana, Calif.—Our squadron and several others have been unsuccessful in ordering repair parts for our Mickey Mouse ear protectors. The plastic and foam rubber ear cushions (PN 2014) wear out long before the rest of the set. The idea of buying complete new sets is quite disturbing when repair parts should be made available at a fraction of the cost.

Any information you can provide will be appreciated. I am sure other squadrons will benefit too.

CPL R. L. SKEATE
H&MS-33, MAG-33
MCAS, EL TORO

• The part number you refer to is the manufacturer's number. Plastic seals for Model 19A and 372-9AN2 ear protectors, Navy Stock No. RD 8415-856-6650-LF50 should be ordered under Stock No. RM 4240-674-5379-LF50. See page 46 for additional parts information.

Vol 12 **approach** No 11

Our product is safety, our process is motivation and our profit is measured in the preservation of lives and equipment and increased mission readiness.

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By John B. Clark, American Airlines, Inc.

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NavAir 00-75-510

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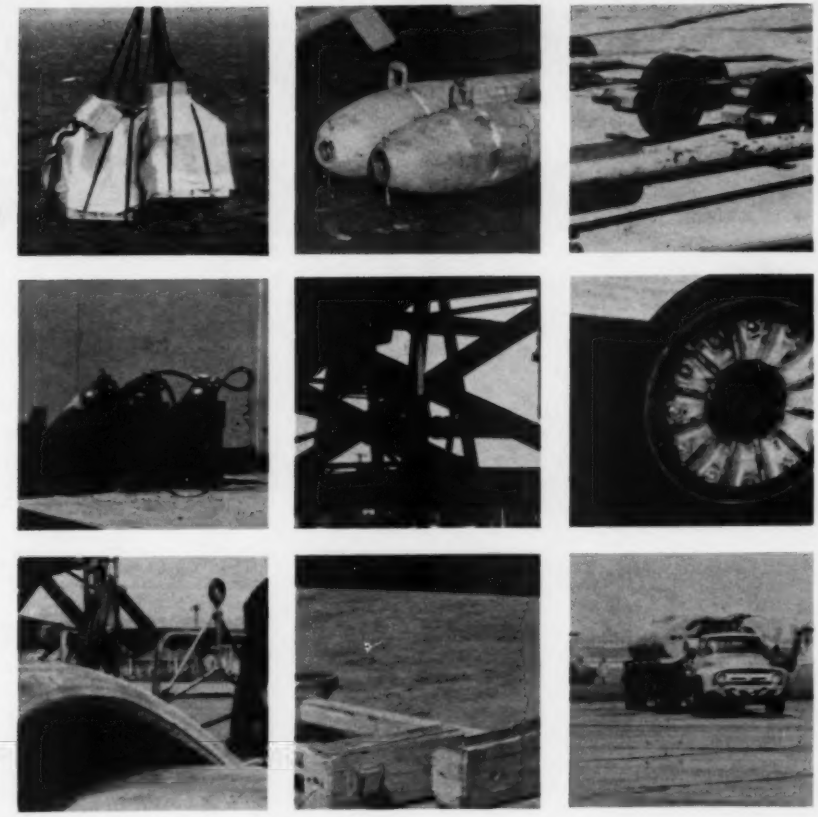


Don't Blame Objects

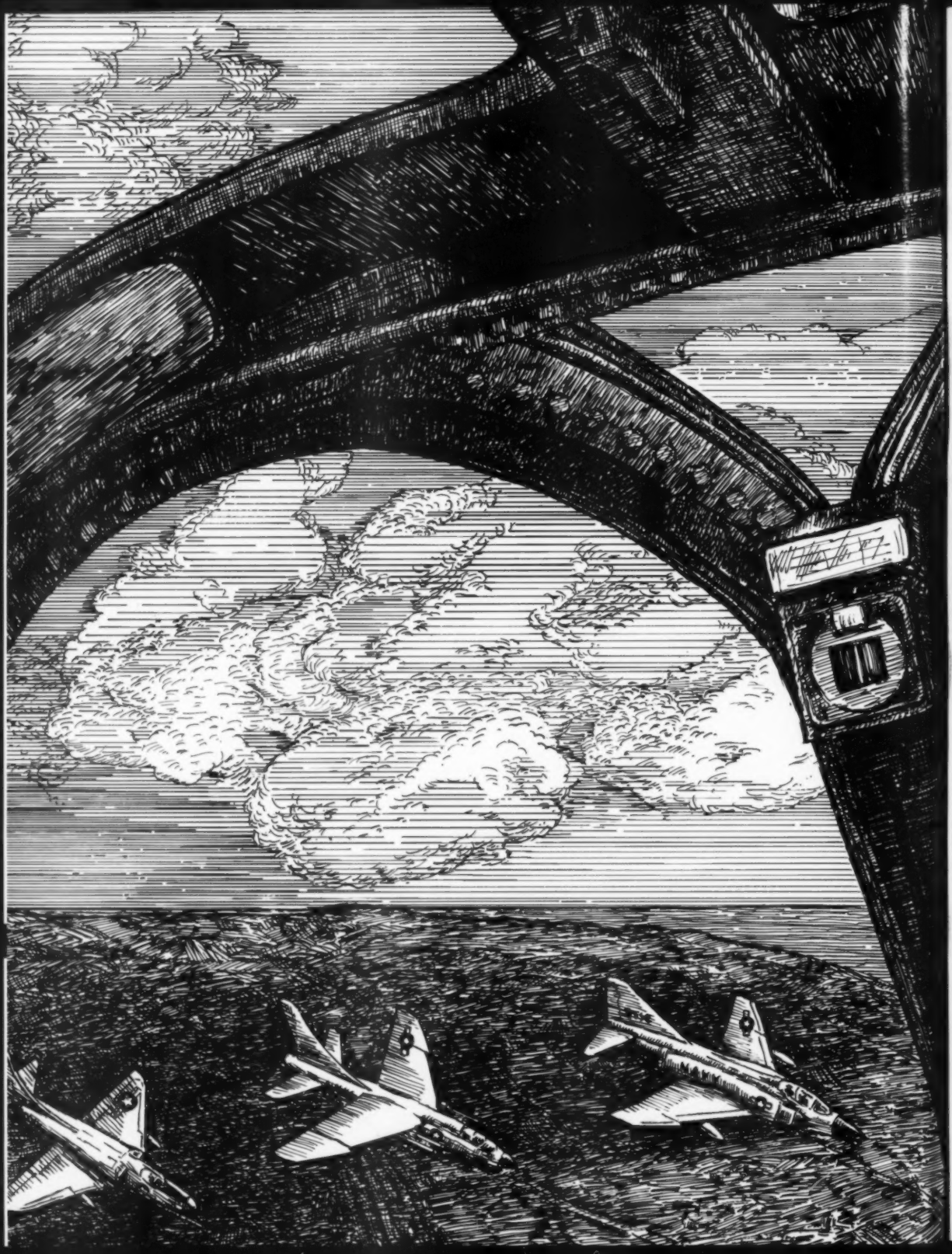
DID you ever listen to someone account for an injury he suffered? Chances are his story went something like this: "I was walking through the building ruins when a nail punctured my foot." Think about that statement. Was it a vicious nail or a careless foot?

It is common for people to blame accidents and injuries on their surroundings—machines, tools, etc., both on and off the job. That's the trouble with safety—people. For without people these objects would lie in peaceful inertia.

Hazardous conditions exist both on and off the job, but these conditions can be corrected or avoided if people use their heads.

Here are a few basic safety measures that are "good any time." Before you start a job:

- Observe all existing and potential safety hazards.
- Eliminate all the hazards you can.
- Plan to cope with the hazards that cannot be eliminated.

—FAA Horizons

LIFT and DRAG